IDEAS THAT MOVED THE WORLD

IN FRIENDSHIP

TO

ARTHUR HADLEY

WHO HAS HELPED SO
MANY TO HAVE THE
COURAGE OF NEW IDEAS

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IDEAS THAT MOVED THE WORLD

Stories of
Dreams and Deeds

BY

HORACE SHIPP

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Contents

Foreword

SPREAD over five centuries, taken from many countries, concerned with all sides of life, these stories have one characteristic in common—Struggle. The struggle of a new, challenging idea, with an old one. And the men and women who took part in that struggle from age to age have one characteristic too—Courage. First, that courage of the mind which does not lazily accept the idea of yesterday, but questions, wonders and then goes adventuring into the unknown. Secondly, the courage of spirit which defies indifference, scorn and persecution in defence of the new truth.

The scientists who, for the sake of their ideas, died at the stake in earlier centuries or faced scorn and neglect in later ones ; the pioneers of a better ordering of society who withstood angry mobs, or endured prison or exile ; the inventors who risked money, reputation, life itself : such men and women are the true heroes of civilisation.

Because of their visions of a new world, and because they had the courage to proclaim those visions, to work for them, fight for them, and never betray them, their dreams have become the reality of our daily living.

THE IDEA THAT MOVED THE WORLD

Copernicus, Bruno, Galileo

FOUR hundred years ago, on the 24th May, 1543, the canon of the cathedral of Frauenberg in Poland, an old man of seventy, lay dying. A group of his friends gather by the bedside, waiting the end of this world-renowned and well-beloved man : ecclesiastic, physician, lawyer, scientist, mathematician, above all astronomer. They await one other thing, a book : a book that is being rushed by messenger from the printer at distant Nuremberg. We can imagine the scene : the clatter of hoofs on the cobbles below, a whispering, a bustling in the hall, and then Osiander, the strange friend of the sick man, swiftly entering the room, pressing into his hand the slim volume, showing proudly the dedication to no less a personage than Pope Paul the Third, opening the title page, reading in his high-pitched clerical voice the Latin words :

De Revolutionibus Orbium Coelestium

Nicolaus Copernicus

Then, with some strange air of guilt, Osiander took the book away.

The old man smiled. " Concerning the Revolutions of the Heavenly Bodies." More than thirty years earlier he had finished that book. He had been a man of forty then, and ever since he had hesitated to publish it, although he had known the staggering truth of it since he was a youth. Lonely knowledge. He had realised that to proclaim that truth would mean a challenge to all tradition accepted as truth for fourteen centuries, would mean imprisonment, torture maybe, the choice between recantation and death at the stake as a heretic. So he had hesitated ; contented himself with careful observation of the stars through the slit he had made in his wall in the room high on the tower of the cathedral ; added fact to fact, calculation to calculation ; dared at times to whisper his secret knowledge to a

few chosen spirits. Even of those chosen ones many had laughed at his fantastic idea that the earth and all the planets moved round the sun, instead of the obvious fact that the sun and the planets moved round the earth. Everything testified to that. Men's eyes told them ; Aristotle and that prince of astronomers, Ptolemy of Alexandria, whose book had been accepted for centuries, assured them ; the Bible said so, for did not Joshua once command the sun to stand still in the heavens ? Chief of all, the Church upheld this doctrine of the world at the centre of the universe, specially created for God's special creation, Man.

Once Copernicus had dared to publish a slight outline of his theory. It had had a strange reception. Pope Leo the Tenth had found it an amusing idea ; and the papal court, always fascinated by curious theories, took this one up and for a time it had quite an intellectual vogue. But nobody took it seriously as the truth.

After that there had always been so much work to do. The demands on him as canon of the cathedral, as a clever physician, as an economist who could plan a new currency for the duke. Then, when his uncle the Bishop, who had loved and helped him, died, Danticus had been appointed and Copernicus had had to face open enmity, censure and persecution for the smallest fault. The dying man thought over those last seven unhappy years under Danticus. How the Protestant, Rheticus from Wittenberg University, had come to watch his astronomy ; how he had stayed for three years instead of the three months he had intended. Then Osiander had come, that sly, curious creature, with his suggestion that Copernicus should publish the book with a preface saying, as Pope Leo had said, that this was only a fantastic idea but might prove an interesting exercise for mathematicians and astronomers. How he had scorned that ignoble compromise. The truth, or silence. Osiander had accepted that at last, had arranged for publication. Now, meditated the dying man, the truth was out, and he, the author..... . We imagine with what a slow smile he slipped away through the gate of death that day they brought his book ; away beyond the tortures of the Inquisition ; beyond the sneers of the dull scholars sunk in age-old untruth ; beyond the wrath of the Church. At least he had lived to read that title-page.

" *De Revolutionibus Orbium Coelestium* "

Copernicus never saw the treacherous preface which Osiander had slipped in—that preface he had forbidden in the name of his new great truth.

So came into the world the book which was destined to change our whole view of the universe and of man's place in it.

With the knowledge which Copernicus first gave us in those pages we find it incredible to-day that men did not understand the motion of the stars. Some among the old Greeks, including that great spirit Plato, did have some inkling of the truth. A daring thinker named Philalaus believed that the earth and all the planets moved about some central fire. Then darkness closed in. In the second century A D. Ptolemy at Alexandria, then the greatest intellectual centre in the world, collected into his book, *Almagest*, the current ideas of astronomy. For thirteen hundred years that book was accepted by churchmen and scholars as the bible of astronomy. It placed the earth at the centre of the universe, and worked out the paths of the sun and the planets around it. *Almagest*, was translated into many languages, including Arabic ; and if the tables which Ptolemy worked out did not fit the facts of the movements of the stars as men saw them, fresh tables were made to account for the differences.

" Sir," said Alphonse of Castile to his astronomy teacher in the thirteenth century, when he was confronted by those confusing tables of cycles and epicycles, 'had I been present at creation I could have given profound advice.'"

More than two centuries passed, and then Nicolaus Copernicus was born at Thorn in Poland. It was an age of daring ideas, and he was its greatest and most daring mind. At his university of Cracow and during ten years study at Bologna and Padua in Italy he mastered subject after subject : medicine, law, economics, natural science, civics, mathematics, art, languages But it was astronomy that fascinated him. Suppose, he thought, that the earth itself spun like a top. People laughed at the mad idea : as if they would not feel it spinning, they jeered ; besides they would be thrown off. With crude instruments, for the telescope had not yet been invented, he worked on his theory. His uncle the Bishop, obtained for him an appointment in his diocese which at first left this brilliant young scholar free to study. At thirty-nine his book was written, and as

we have seen, was withheld from publication for more than thirty years of hesitations in face of the threat of the Church. But with his death the truth was freed.

It was left for another brilliant mind, another more courageous man, at the cost of his liberty and his life, to press home that truth.

Giordano Bruno was born at Naples seven years after the death of Copernicus. He was a Dominican monk, but when he was twenty-four fled from his monastery in fear of an accusation of heresy. Rome, Venice, Padua, Geneva, Paris, Toulouse, Paris again, Oxford, Marburg, Wittenberg, Frankfurt, back to Venice : from city to city he went proclaiming his ideas and risking everywhere the fury of the Church. Chief among his heresies was the new astronomy. Bruno worked out its implications. He saw man as a minute speck in a universe of infinite space and an infinite number of worlds, and he hurled the fact at the Church with all the fury of his courageous soul. He paid the price. In Venice he was at last betrayed and arrested by the Inquisition. For six years he was kept in the dungeons of Rome while theologians and monks tried in vain to make him recant. But Bruno was not the type of man who could be made to deny the truth as he knew it, neither by physical torture nor by death itself. To the end he was faithful to his belief. On 17th February, 1600, he paid the price of that faith at the stake, and when they offered him a crucifix to kiss amid the flames he turned his head away.

> "You who sentence me are in greater fear than I who am condemned,"

he told his judges ; and he left us that testament of courage in a last speech which ranks with that of Socrates :

> "I have fought. That is much—victory is in the hands of Fate. Be that as it may with me, this at least future ages will not deny of me, be the victor who may—that I did not fear to die, yielded to none of my fellows in constancy, and preferred a spirited death to a cowardly life."

So Bruno the fearless died for the truth that Copernicus had discovered. But the stake and the cross never kill the truth.

Galileo, that experimentalist who sought the truth of Nature in everything, had already made himself champion of the idea. The news of Bruno's death frightened him a little, but when four years

later he became the first man to see a new star his popularity as an astronomer went forward sharply. In 1608 a Dutch instrument maker created the first telescope, and immediately Galileo put the new instrument to use despite the Church assertion that it was an instrument of the devil which created visions of things for man's temptation. So the Church banned it ; orthodox astronomy refused to look through such an instrument ; but Galileo persisted. Copernicus had declared that Venus must have phases like the moon, and through the glass Galileo saw them. Study of sun spots showed him that even the sun revolved. He saw Jupiter's moons and a thousand and one other marvels of the sky.

In 1616 he faced the solemn condemnation of the College of Cardinals who proclaimed the Copernican theory to be heresy. He promised not to teach it, but when a new Pope was elected who might be more tolerant Galileo wrote a clever dialogue between the Ptolemaic and the Copernican ideas, pretending that it was to show the absurdity of the heresy. Truth shone too clearly through that subterfuge ; and the scientist, now himself approaching seventy years old, faced the Inquisition. They made him recant the truth he knew, and legend tells us that he murmured after his recantation : "*E pur si muove.*" ("And still it moves.") For nine more years, blind and helpless, Galileo was kept in prison, and then he died.

Still truth moves. Through mind after mind ; despite ban and edict. Through torture, imprisonment, martyrdom ; Tycho Brahe, the Danish astronomer, swung back partly to the old Ptolemaic system ; but he had already trained Keppler, and as the seventeenth century—that century of enlightenment—dawned, Keppler, by establishing the idea of the elliptical movement of the planets gave the final answer to doubters. The idea that the world moved was accepted at last.

* * *

"It is a poor mind that will think with the multitude because it is multitude ; truth is not altered by the opinions of the vulgar or the confirmation of the many."

Giordano Bruno.

MAGIC IN MATHEMATICS

The Ideas of Isaac Newton

IF most of us were asked what we knew about Isaac Newton, we should probably reply that he discovered the laws of gravity through watching an apple fall from a tree in his garden. So far as it goes the answer would be true; for years after that charming story had gone into circulation his niece, who was also his housekeeper, confirmed the truth of that incident in the garden of the old house at Woolsthorpe in Lincolnshire. But it tells us too little of this man whose mind was one of the most remarkable in the history of human thought; whose discoveries marked the end of one period of mankind and the beginning of another; whose genius in mathematics laid the foundation for the scientific discoveries of the ages of mechanical triumph which followed; and strangest of all, who lost interest in all this—if, indeed he ever had any.

A curious creature this Isaac Newton, a little like one of those He-Ancients in Bernard Shaw's Methuselah drama. He seems to have had no friends, no emotional life at all, unless his care for his mother indicates love. He had a power of concentrating his mind on any abstract problem with such intensity that he might almost have been in trance. In that state the answers to the most difficult problems of mathematics were arrived at, or at least the sure method of arriving at them was found. Newton reluctantly published the results of his discoveries, and then as though by accident. The book which gave to the world his great findings about gravitation was held up for twenty years after he had in fact made those discoveries, and its appearance even then depended upon a chance visit of the astronomer Halley. Strangest of all, for the last forty years of his life he took no further interest in any of these subjects.

He was born on Christmas Day, 1642, the same year that Galileo died. Galileo had himself been concerned with precisely the problems

which were to occupy the mind of this yeoman farmer's son in Lincolnshire. He had been studying the force which caused balls to run down sloped wooden planks, and calculating how far they would go up a plank inclined the other way. Why do things move? What force is at work in each instance: the wind moving the sails of a mill, the balls rolling down the boards, the stars swirling round the sun? For Galileo knew, in spite of his recantation under the torture of the Inquisition, that the stars did move through the heavens. Why do things move?

Young Isaac Newton seems to have taken up the quest. As a schoolboy there are stories of his mechanical creations, kites and a little mill whose motive power was a mouse on a treadmill inside. Record has it that he was not a particularly bright boy at school; and just when his mind sprang into activity (to outdo a bully who had kicked him, so the records say) his mother took him away from school to run the farm, for his father had died just before Isaac was born. He was a poor farmer, his mind never on the farm work but invariably on some new "gadget" which intrigued him. After four years, at the advice of friends, Mrs. Newton sent him to Cambridge. Isaac Newton was then nineteen.

By the time he was just turned twenty that astonishing mind was already set on its task of the discovery of natural laws. In 1664 he made his famous experiment with a prism which revealed to him the nature of light. This had long puzzled the scientists. Newton made a small hole in the shutter of his room, allowed one beam of sunlight to strike through it on to a prism, and saw that the rays of the different colours were bent at different angles, thus splitting up the pure white light into the seven colours of the rainbow. Through another prism he was able to rejoin them into white light again. Dissatisfied with the type of telescope which had served Galileo, and using his new knowledge of the nature of light and the laws of the bending of light rays through lenses, Newton invented the telescope on the system which governs its construction to-day. Out of those studies into the analysis of the spectrum has come the whole technique of modern spectrum analysis which is the basis of research in present-day astronomy. One result of the invention was that the young man was invited to become a Fellow of the recently formed Royal Society. Another was his book on *Opticks*.

The next year Cambridge suffered from an epidemic of plague, and the twenty-three year old Newton went home to Woolsthorpe for nearly two years. It was during that period that he made his greatest discoveries, his marvellous mind seeming to blossom into its utmost brilliance. It was then that he established the mathematical laws of gravitation which governed our knowledge until Einstein built upon them his superstructure of relativity.

The rough fact of gravitation had already become subject of investigation, as we have seen, to such minds as that of Galileo. Newton reduced it to mathematical law. Indeed, the particular contribution which Newton made to human progress was that he used mathematics in every situation to solve every problem. Measure. Everything, he believed, had a mathematically measurable cause which would give a mathematically predictable effect. It was not, therefore, only that he was concerned with an apple falling from the tree in his sunlit Lincolnshire garden, but that he worked out exactly how quickly it fell; and from the measurement of time and space deduced the whole law of movement between bodies, which governed the movement of the earth, the moon, the stars. And also he showed us the fundamental fact of mechanics in his passion for exact measurement. For two hundred and fifty years since, the whole of science has accepted that basis for its method. Newton stood at a parting of the ways: behind him was guesswork, the acceptance of all manner of mystical explanations or evasions of problems; after him, along the way he pointed, was the belief that Newton's laws were measurable and calculable. With Newton, "the greatest genius that ever lived," we move into the age of mechanics.

It was during those years at Woolsthorpe, too, that he invented that complicated piece of mathematics, the differential calculus, to give him power to make measurements of things which could not have been measured before. He invented it, as he had invented his telescope, because he wanted an instrument.

During those three years in his early twenties Newton thus made three revolutionary discoveries: the laws of optics and of the composition of light; the laws of dynamics and of gravity; and the mathematical method of the differential calculus which enabled later scientists to continue his vast work of exact measurement of speed and acceleration It is part of the strangeness of this man that he

made no effort to exploit these discoveries or to gather fame or reward by publishing them. None of them was revealed until many years afterwards. He went back to Cambridge, continued his investigations and calculations, and put aside for years the results

In respect to gravitation, he was first put off by the false idea which existed about the dimensions of the earth, for it was the essential basis of his theory that the size of one body in relation to another governed its power of attraction. Many years later the correct diameter of the earth was made known, and forthwith Newton's observed measurements of its pull upon the moon were correct. Still he made no effort to publish his discovery. In 1687, twenty years after Newton had made his calculation, Halley the astronomer visited him to question him about the path of the planets round the sun. Newton assured him that this path was an ellipse and not a circle. He had calculated it but had lost the papers, so he worked it all out again for Halley's benefit. In that conversation he revealed his manuscript, the *Principia* which embodied his laws of gravity, and Halley determined that it must be published. As the Royal Society had used all their available funds to issue a book on Fish, Halley himself paid the costs, for Newton had so often given large sums to assist the publication of the work of other scientists that he had no money for his own. So, almost by chance, this enormous discovery was made known to the world in 1687.

Newton, although he was still only forty-four years old, had almost lost interest in this whole subject In the quiet of Cambridge he pursued curious studies in Biblical affairs. For the second half of his long life he carried on his duties as Master of the Mint to which he had been appointed, and wrote dull (and completely erroneous) studies of Biblical chronology, based on the idea that the world was created in the year 4004 B.C. So this greatest genius in the vast field of mathematics, this man whose concentrated thought as a youth of twenty-three had altered the whole of our conceptions of the universe, turned his back on his own noble speculations.

* * * *

" I have been but as a child playing on the seashore, now finding some prettier pebble or more beautiful shell than my companions, but the unbounded ocean of truth lay undiscovered before me."

Sir Isaac Newton.

FOUNDATIONS OF PHYSIOLOGY

The Idea of William Harvey

IN the story of man's knowledge of the world and of himself no single century is more important than the seventeenth. It was then that the modern age of science had its beginning. Men turned their backs upon the Middle Ages, upon alchemy and magic and the domination of the Church in scientific affairs, and looked to exact measurement, definite natural laws, mathematics, to solve their problems and help them to live.

One of the remarkable things which happened was that a group of these newer spirits began to meet in London at the rooms of a certain Dr Goddard, or at an inn called The Mitre near by. They met every week "at a certain day and hour, under a certain penalty, and a weekly contribution for the charge of experiments." Also they "barred all discourse of divinity, of State affairs and of news other than concerned our business, confining ourselves to Physick, Anatomy, Geometry, Astronomy, Staticks, Mechanicks and Natural Experiments." Most of them were young men, and when John Wilkins, the moving spirit, was appointed to be Warden of Wadham College at Oxford, the little club continued there.

It may seem nothing to us now that a group should meet to discuss pure science, but it was a new thing in those days; and when the society came back to London in 1658 it was already in correspondence with the same type of thinker all across Europe. In 1660 Charles II. was made king, and, whatever his faults in other directions, he was keenly interested in these questions of scientific advancement by experiment and the gradual recording of facts. In 1662 he gave the group a Royal Charter, and so the famous Royal Society came into being; one of the first in Europe and an abiding symbol of the new spirit which had come into the world. Doctors, architects (including Christopher Wren), mathematicians, mechanicians, chemists: the

men of science had a meeting-place and a clearing-house for their ideas. Those ideas were published officially by the Society, and so made available to other thinkers and workers. The Royal Society was a typical product of the seventeenth century.

It was the spirit of that age, a spirit which found a noble embodiment in the person of a certain William Harvey. Under its guidance Harvey established one new idea which revolutionised our knowledge of the human body and established physiology on a sound basis, for William Harvey discovered the circulation of the blood. Not the least strange fact about it was that the announcement of his tremendous discovery ruined his private practice as a doctor, so unwilling were people to believe what seemed to them a fantastic idea.

Harvey was born in 1578, the son of tolerably well-off parents, at Folkestone. His first university was Cambridge; but the thing which probably influenced him most was that at the age of twenty-one he went to Padua. The Italian university happened to be leading the world in those days in its medical science, for the great Vesalius had been Professor of Anatomy there at the beginning of the century, and his genius had been carried on by Fabricius who was the Professor when Harvey arrived. Fabricius had already made some anatomical discoveries about the flow of the blood, and in a little book published in 1603 had pointed out that along the veins were a series of "little doors"—valves, in fact, which opened only one way.

Harvey returned to London about that time, full of these new ideas. As we have seen, he came to a world which was beginning to apply the methods of experiment, and he started to do this in his own department of anatomy. He was appointed to St. Bartholomew's Hospital in 1609; and more important still, he was given the position of Lumleian Lecturer to the College of Physicians in 1615. Part of his duties was to give a number of public lectures, and in the second of these he lectured on his favourite subject of the structure of the heart and the flow of blood.

It must have been a strange scene that day in 1616 when Harvey made public his discovery. On the table lay the corpse of a criminal who had been executed the day before. At either end stood the Assistant Masters of the Scalpel, ready to dissect at the instruction of the lecturer, who stood behind the table with his long pointer; row

upon row in a semi-circle around sat the surgeons, the officials of the college, the students and members of the general public, the officers of state. The little dark man proceeds to say things which stagger his hearers. The veins carry blood to the heart, he declares; it enters on the right side, is flooded into the lungs, cleansed by the air in the lungs and passed over to the left side of the heart, and then pumped into the arteries and around the body again. The same blood, over and over again. In one-half-hour, he pointed out, the heart pumps from its chambers more blood than is contained in the whole body. Where does it come from ? Under his insistence the audience stir restlessly. For centuries now the theories of Aristotle and of his disciple, Galen, had been accepted. Moreover, the arteries were avowed to contain pure spirit. This newcomer to the College of Physicians was overthrowing the knowledge held by all mankind for two thousand years.

Angry at their reception of the truth which he had been working upon already for fourteen years in the new experimental way, Harvey threw down his wand and left the theatre. Back in his own laboratory, he continued his research. Reptiles, fish, birds, snails: he examined all living things and always he found his theory upheld by the facts.

In 1628, thirteen years after that day in the lecture-room, his book was published in Frankfurt. *Exercitation Anatomica de Motu Cordis et Sanguinis in Animalibus*, it was called, a long Latin title after the fashion of that time. Its publication brought to a head the controversy between the old school of traditional thinkers and the new men of science. The public, informed or uninformed took sides. It was a matter of challenge to old, safe ideas. William Harvey found his private practice dwindle, as his patients shied from this sort of new talk about their bodies.

There were other things whispered against him. Had he not interfered in a famous case of witchcraft when the boy Robinson had given evidence against a number of women whom he had seen transformed into dogs ? This William Harvey had simply used his influence with the king, whose physician he had become, to pooh-pooh the whole idea of witchcraft. The women had been acquitted. Popular superstition was set by the ears. The mere fact of his friendship with Charles I, in those days when feelings were beginning to run high between commons and king, was sufficient. Indeed, he was

always a king's man, and there is a story that at the battle of Edgemoor he was given charge of the two young princes, and was with them reading a book under a hedge when the splatter of bullets around him showed him the danger of his position. More serious was the fact that the mob broke into his house and, as he said :

> "certain rapacious hands not only stripped my house of all its furniture, but, what is a subject of far greater regret to me, my enemies abstracted from my museum the fruits of many years of toil. Whence it has come to pass that many observations have perished. Let gentle minds forgive me if, recalling the irreparable injuries I have suffered, I give vent to a sigh."

For William Harvey was concerned chiefly with his work, with the truth as he saw it and as scientific method revealed it to him. He was so personally helpless with money that his brother had to keep the purse to prevent him from giving it away to anybody in need. As it was, he built for the College of Physicians a splendid library, and filled it with his choicest scientific books.

But the legacy he left to mankind was that great discovery. Once it had been accepted and physiology became an exact science, doctors knew how they must work ; the whole question of hygiene, fresh air as one of the true essentials to health, food and dietetics, everything which concerns human health, indeed, was put on a correct foundation. When a few years after his death in 1658 the men of the new science began to use the microscope, that marvellous new instrument which the times placed in their hands, everything which Harvey had said was proved beyond all shadow of doubt. Another realm of human knowledge had been captured by a pioneering spirit which would not be defeated by the prejudice of centuries, or turned aside by popular clamour.

* * *

"It were disgraceful, therefore, with this most spacious and admirable realm of nature before us, and where the reward ever exceeds the promise, did we take the reports of others on trust . . . . Nature herself is to be addressed ; the paths she shows us are to be boldly trodden ; for thus and whilst we consult our proper senses shall we penetrate at length into the heart of her mystery."

William Harvey.

THE FATHER OF MODERN CHEMISTRY

The Ideas of Antoine Lavoisier

ON the 8th May, 1794, just one hundred and fifty years ago, the Terror raged in Paris. Fourth on the guillotine that May morning was a man of fifty-one years of age, a certain Antoine Laurent Lavoisier, a rich citizen of the old regime, a member of the Academy of Sciences, once the friend of the king Louis XVI, and an official under both the old and the new government of France. The great blade flashed downward in the sunlight.

> "It required but a moment to cut off a head the like of which a hundred years will not produce,"

wrote one commentator on that morning's work. And it is true that this man who was hounded to his death by the jealous hatred of the fanatical Marat was one of the greatest men of his time—indeed, of all time.

How shall we appraise him? As a brilliant scientific theorist who first laid down the fundamental laws upon which modern chemistry exists? As the man who discovered the nature of fire? As a lover of his fellow-men and great democrat who in an age of oppression used his wealth and his knowledge to help the poor? As a practical man of affairs, who at the head of the French Treasury worked out a decimal coinage and the metric system of weights and measures? As an educationist, pioneer of technical schools? As the creator of a model farm so good as to attract visitors from all parts of the world, and the progenitor of that Committee on Agriculture which offered to the French peasant the idea of scientific farming? As one of the first men to regard nutrition as a science, and food as a subject for mind rather than merely for taste? As originator of a scheme for old-age pension insurance? As a philanthropist who gave £38,000 to a famine fund in the country district where he had an estate?

Lavoisier was indeed all these things, any one of which would ensure him a place of distinction in the history of human progress. So he stands : a supreme example of a great and good man.

It is his contribution to chemistry, however, which remains the most far-reaching of all the work he did. Before his time stretches century after century of guesswork, error, deliberate necromancy, and at best a blind stumbling after some sort of truth. With him comes a basic theory, the use of the balance to obtain exact knowledge, the discovery of some of the fundamental laws of Nature. Upon these theories chemistry has worked ever since. Lavoisier has rightly been called the Father of modern chemistry.

From the beginning he was a brilliant creature. He was wealthy, handsome ; but, more important than these accidents of birth, he had a marvellous brain. We glimpse him first as a student under that Professor Bourdelin who daily gave his fashionable talks on scientific matters in the garden house of King Louis XVI. The professor was a disciple of the German, Stahl, and he was propounding that master's theory of the nature of fire—a theory which captured the scientific world for more than a century. Everything, declared he, contains in lesser or greater degree, *Phlogiston*, that is, "fire-stuff" ; and when anything burns, the fire-stuff leaves it ash and is itself absorbed into the air as water is absorbed into a sponge. The idea was universally accepted. Did not our eyes support it ? The candle burned away ; wood fell into ash ; everything obviously lost something in this process of burning, the nature of which had interested man since the beginning of thought, but had never been truly known.

The young student who listened so attentively to Professor Bourdelin and watched so intently his experiments, watched also a rival theorist demonstrate that a pound of sulphur weighed *more* after it was burned than before.

Why do things burn ? What exactly does happen ? He shocked his wealthy family by deciding to live on a simple milk diet so as to waste less time eating, that he might the better study these problems. But he early attracted attention. At twenty-three he had received a medal from the king for an essay on the lighting of Paris streets. He published a scheme for bringing the pure river Yvette as drinking-water to the city : another for providing water hydrants against fire. They did not, in fact, light the streets his way, or bring the water,

or provide the hydrants, but they made him a Member of the Academy of Sciences when he was only twenty-five. He belonged to that type of mind which demanded exact experiments; and realising that these would cost time and money he went into business in the State *Fermes*, that old company which for centuries had purchased from the king the right to levy taxes. These *Fermiers* were hated by the people, for they had a reputation for extorting sums enormously above those they paid for the privilege; but Lavoisier from the beginning was a friend of the taxpayer, and rich man though he was, he looked after the poor. He said :

> "If it is possible to make exceptions in the levying of taxes, it can only be done in favour of the poor."

Life for Antoine Lavoisier was not a matter of squeezing profits from the framing of taxes. He liked the work because it took him all over France, and enabled him to see so much. He established a model farm on his estate at Blois, and persuaded the king to set up a Commission on the Development of Agriculture. As a side-issue he became intensely interested in the scientific question of food, and on that subject of diet which is only just beginning to be dealt with to-day. His contacts as a *Fermier* with the poor French peasants led him also to advocate the establishment of a scheme of contributory insurance to provide old-age pensions.

It was back in Paris, however, that his true work lay. He had married a young girl, Marie, the daughter of the banker Paulze. She had a mind comparable to his own; and when they made their home he built a laboratory with the best equipment he could buy, and Marie became his assistant, the translator of his writings and of foreign writings to him, the illustrator of his books, his secretary, and the hostess of the brilliant parties which they gave to the intellectuals of their time.

In that laboratory, with her assistance, he continued his experiments on the nature of fire. For eleven years he carefully burned different substances under exact conditions, using sealed vases and weighing the ashes, the vases and the air. Lavoisier made his great discoveries from these experiments. He also taught men how to work at chemistry. When he burned a piece of tin he found that the ashes did in fact weigh *more* than the original tin, but that the

air in the case weighed *less*. Amazingly, ash and air together weighed exactly the same as they had done before ! It led him to the establishment of an astounding truth : matter is indestructible ; weight in Nature remains in sum always the same, merely passing from substance to substance ; no matter is ever lost, but merely changes its chemical composition. It was a new light on the nature of the universe.

It led him at once to enquire into the true nature of this air which could thus give part of itself to the ash by burning and leave a residue which proved to be unbreathable. Here he linked up with the great British scientist, Priestley, who had told him of his own discovery of a gas in the air which breathed alone produced a strange liveliness. It was Lavoisier who gave that gas its name. "Oxygen" he called it, for he found that burned sulphur left acid in the dish, and knowing now that this gas was the agent in the burning he called it by this Greek word which means "acid-maker." Equally when Cavendish, another English scientist, found a gas which burned, Lavoisier discovered that added to oxygen it created water, and he named it "Hydrogen," "water-maker." Not the least part of his service to scientific chemistry was his standardisation of names.

Air, fire, earth, water ; the old Greeks had believed these to be the four elements ; and mediæval alchemy, if not accepting this doctrine in its simplest form, had found nothing to put in its place. Now Lavoisier came, and building his own exact theories on the discoveries of men like Priestley (who still accepted the Stahl theory) and Cavendish, showed us the underlying truth of Nature. Always he weighed and tested. Exactness. The balance : that was his instrument for exact measurement, and it revealed to him this secret of Nature as a vast chemical factory, eternally at work. The human body, too, he realised was of this kind, making its heat by burning oxygen, changing its tissues, eliminating waste ash, creating anew.

When the French Revolution came Lavoisier welcomed it, and immediately undertook his own great part in constructing that new world. He had always worked for and loved the people. Had he not visited prisons and hospitals and striven to improve the lot of the wretched creatures who were in them ? A rare enough sympathy in those days. The new government put him at the head

of the Treasury. He refused a salary, pointing out that he already had enough money to live on and wished only to serve. Forthwith he worked out a decimal system of coinage and the metric system of weights, and so standardised for the whole country the means of exchange and the terms of buying and selling. He turned to education, and declaring that all children should be educated, he worked out a system for practical technical training, and began to revise the whole school curriculum of France.

But in high places Marat—himself a dabbler in science who once had had a paper rejected by the Academy, and believed Lavoisier to be responsible—turned the mad weapon of the Terror upon this man whom he hated. Scurrilous articles attacked him as aristocrat, friend of the ex-king, a man of fortune, and above all, as one of the hated *Fermiers*. An order was made for the arrest of no less than four thousand of these men who had constituted the *Ferme*. Lavoisier was urged to fly by his friend, but he deliberately gave himself up.

"I have lived a useful life, and I am ready," he said.

The scientists of the world petitioned for him. Marie risked her own life by going to Paris to plead on his behalf. He himself asked for two weeks of life to complete an experiment he was making on perspiration. But the judge, Coppinal, refused all.

"The Republic has no need of scholars," he declared.

Two years after Lavoisier's death the Republic tried to make amends by honouring this man whose body had been thrown into a common grave. Now for a century and a half the world has echoed those belated funeral orations. The mistakes of ages had been rectified by that brilliant mind. The manner of chemical research had been brought to something like perfection in his laboratory. He had put new instruments into our hands, new words of exact meaning into our mouths. All chemistry goes on from the place where he established it Lavoisier, great citizen of the world, the Father of modern chemistry.

* * *

"He continues to live; through genius he still serves humanity."

Inscription on the portrait bust of Antoine Lavoisier.

RELIGION IN REVOLT

John Wesley and the Evangelical Revival

IF ever the dreams and deeds of one man wrought a change in his generation, those of John Wesley did in the life of the eighteenth century. What a fascinating creature he was! Wherever we touch that long, energetic life we are brought up against a personality so remarkable, an idea so dynamic, that we cease to wonder at the changes in social condition which he caused. Said Thomas Hardy:

> "Great men are meteors that consume themselves
> To light the earth."

Wesley was one of those men.

The Wesleys were a remarkable family: the father a parson; the mother, a lady of determination who dominated her children; a number of sisters; the three sons, Samuel, Charles and John. Samuel alone was a respectable orthodox parson who followed in his father's footsteps and spent his life trying to keep his brothers—especially John—within bounds. But Charles and John were made of different clay. They too became parsons, but they took their religion seriously. That may not sound anything to us to-day, but we have to remember that the church of their time was almost everywhere a mere livelihood to its parsons, a fashionable meeting-place to its congregations, and no sort of check on wrong-doing. It had scarcely any influence for good on the people, either rich or poor. The Wesleys, with their brother labourer, George Whitefield, simply altered all that. Initiating the movement we call The Evangelical Revival, they brought Christianity back to vivid life.

That movement took the teaching out of the almost empty churches and preached it to vast congregations of thousands who gathered to hear it in the open fields and the market-place. It spread like wildfire through England to America, and back again. It

attacked social wrongs instead of quibbling about petty questions of theology. It bade the poor to turn from the terrible drunkenness filth and brutality of their miserable lives. It attacked the rich for their greed, their drinking, their gambling, their oppression of the poor. It took the side of the slaves in the fight against slavery, which was the greatest struggle of that century. It left an impetus which started practically all the great reforms of the century which followed. Wilberforce and Shaftesbury were its children; and factory reform, prison reform, child welfare, education, the care of the poor, the lunatic and the sick were part of the wonderful aftermath. It is not too much to claim that John Wesley was more responsible for all this than any other individual man.

Even as undergraduates at Oxford, John and Charles created a sensation by being different. They wore their hair long, they founded a "Holy Club" whose members were serious thinkers and good livers among the dissolute gay young men of the university. They disciplined their bodily weaknesses. John, for instance, found that getting up in the morning was a difficulty. So he took himself in hand. Six o'clock; five o'clock; four o'clock. he rose earlier and earlier. John Wesley had overcome *that* trouble.

When, immediately after his Oxford period, John was offered his father's pulpit he refused because that comfortable country living was not his idea of what life demanded of him. So he and Charles went off to America to convert the Indians. On the way out he gave up his comfortable cabin to accommodate someone in need, and he slept on any more or less level surface that offered.

> "I believe I shall not find it necessary to go to bed, as it is called, any more,"

he wrote in that famous *Journal* of his, which throughout its record of more than fifty years of thrilling living tells us so much of this man and the world in which he lived.

In many ways that American mission was a failure, almost a comic failure, for John was young and handsome and earnest, and did not realise the havoc his personal qualities and charm aroused in the hearts of the ladies of New England. There were quarrels and troubles and jealousies. The white folk found the missioners uncomfortable creatures, who insisted that true Christians would enjoy services at

five o'clock in the morning. If John Wesley came home from America rather under a cloud it was more his innocence than his fault.

Back in England he met that deeply religious man, Peter Bohler, and under his influence Wesley began even more earnestly to examine his own life and state of salvation. Something like a definite conversion took place, and he saw that henceforth his mission must be to go to the people themselves with his now blazing faith in the power of Christianity to make men lead the good life.

He joined Whitefield, with whom he had worked in America in the extraordinary experiment of "Field preaching"—open-air mission work which scandalised the respectable, but brought a message of hope to hundreds of thousands who would never have entered a church. That was the beginning of a campaign which John Wesley led for fifty years. He demanded personal goodness and self-discipline from every individual as an expression of their religion. A good society, he believed, would inevitably emerge from this widespread good living of each man and woman. He was thus ethical and practical.

> "Christianity," he said, "is essentially a social religion; to turn it into a solitary religion is indeed to destroy it."

That new faith ran through England in a wave of regeneration Drunkenness on the twopence-a-pint gin which was damoralising the whole working-class; widespread sexual immorality; the awful brutality of our "sports" of cock-fighting and bull-baiting, and the mad gambling which went with them; the dirt; the neglect of children and homes: these things and a score of other evils crashed down before the flood. All over the country vast masses of the poor were redeemed from a state of hopelessness and turned into decent citizens as John Wesley took the message of his faith to them.

That was, above all, the work that he did; and in the *Journal* we have the record of his adventures on that quest. Every year he rode more than four thousand five hundred miles on horseback, undaunted by the weather, unafraid of the drink-maddened mobs who stoned him and beat him and dragged him before magistrates at the instigation of those gentry whose livelihood or comfort his preaching challenged. The riots went on for years. Once at Wednesbury a mob dragged him miles through the rain to a magistrate, who would

have nothing to do with the affray, especially as already half the assailants were claiming him as an "honest gentleman" for whom they would "spill their blood." So they pulled and pushed him to Walsall; but there the magistrate was in bed, so the Wednesbury mob decided to escort him home, since by now a crowd of Walsall men were on the warpath to beat up the preacher. For three hours he was pushed up and down the streets between the rival crowds. Some cried, "Kill him!" "Hang him on a tree!" "Drown him!" Others offered to give their lives for him, though they had started out to lynch him. One man rushed at him with a cudgel, but let it drop and stroked the preacher's head, saying, "What soft hair he has!" When he was struck he felt no pain, though blood gushed from his mouth. Once when he tried to stand in a doorway he was dragged back into the *melee* by the hair of his head. It was a typical scene in that age of violence which loved a riot. Wesley's movement gave them an excuse.

The next morning the magistrate issued a warrant for Wesley's arrest on a charge of causing the riot. But probably Wesley, up at four o'clock in the morning as he invariably was, was already riding into new jeopardy miles away, singing as he rode, or reading on horseback as he usually did.

Weather could no more hold up John Wesley than mob violence. Nor could illness. Hear the *Journal*:

"*Sunday*. I was very weak and faint, but on Monday I rose soon after 3." The servant came and told him that the snow blizzard was too fierce for them to set out. He answered: "At least we can walk twenty miles with our horses in our hands."

The *Journal* goes on to record:

> "So, in the name of God, we set out. The north-east wind was piercing as a sword and had driven the snow into such heaps that the main road was impassable. However, we kept on, afoot or on horseback. . . ."

"However, we kept on." Nothing deterred this man. Over hundreds of thousands of miles of England he carried his message, bringing hope, happiness and a new way of life to untold millions. Twenty-one times he crossed to Ireland.

He felt from the beginning that he must create some sort of

organisation of his own, and he founded the United Society of Methodists, members subscribing a penny per week to establish their own regular meeting-places. Wesley did not realise that he was creating a new church ; for thirty years or more he regarded his work as that of an ordained priest of the Church of England. Events at last forced his hand ; but already the Society had its own buildings all over England, its own funds, its own lay preachers, a dispensary in London and one in Bristol, and an orphanage in Newcastle. Everything in the organisation was directly in John Wesley's hands : he could not bear to lose control of any part of it. Somehow he found time and strength to do all the organisation as well as the unending preaching journeys. As a kind of sideline he wrote and edited over four hundred books, chief of which is the magnificent *Journal*. So when he died, at the age of eighty-eight, he had altered the outlook of the society of his day, had shown the power of applied Christianity, and had revealed once again the value of a dream when the dreamer turns it into action and gives himself to its fulfilment.

* * *

" Do all the good you can
In all the ways you can
In all the places you can
At all the times you can
To all the people you can
As long as ever you can."

*

" I desire to have heaven and hell ever in my eye while I stand on this isthmus of life between two boundless oceans."

*

"He who governed the world before I was born shall take care of it likewise when I am dead. My part is to improve the present moment."

*

" Though I am always in haste, I am never in a hurry."

*

" Christianity is essentially a social religion ; to turn it into a solitary religion is to destory it."

John Wesley.

THE RIGHTS OF MAN

An Idea of Jean Jacques Rousseau

LIBERTY ; Freedom ; Equality ; Democracy.

To-day we hear those words so often that we cannot believe there was a time when they were the battle-cry of a new challenging idea, an idea which shook civilisation to its foundations, which ended one period and initiated another. Nor do we pay our debt of gratitude to Jean Jacques Rousseau, who far more than any other man was the founder of that idea. There were others who were beginning to think as he did; indeed, the suggestion was "in the air" during the second half of the eighteenth century, and especially in the air of France. But Rousseau gave it shape and power.

He made it the keynote of his life and of his books. Out of one of those books the French Revolution was born. Out of another came the new ideal in education which a hundred years later blossomed into the works of Froebel and Madame Montessori and the other advocates of free expression and free discipline. Out of a third came the romantic novel with its passion for Nature. Out of a fourth a new kind of autobiography, one which told the whole truth about oneself even when that truth was shameful and unflattering. This Jean Jacques Rousseau was truly a modern. His writings made these startling changes simply because, like people of our own time, he believed in liberty, equality, and democracy; but he happened to believe in them when nobody else did. And, moreover, he acted on his beliefs. People were beginning to feel that way, however, and when he put their vague feelings into words they heard them as a trumpet call, thrilled, and rallied to this brave new standard.

It was nearly thirty years before that standard became the Red Flag of the French Revolution; but it was Rousseau's cry of "Liberty, Equality and Fraternity," which on that fateful day, the

14th July, 1789, sent the populace of Paris to the storming of the Bastille. And however often we may have betrayed that ideal, the world has never been the same since.

Born in 1712, Rousseau himself died poor and lonely eleven years before the Revolution. His was a strange life. A brave one for he was always in conflict with the world of his day, and he would never be untrue to the principles in which he believed.

He was the son of a watchmaker in Geneva, and such education as he had was gained at a little village school. Thus he belonged to those "common people" who for the first time in the world were idolised in his writings.

> "It is the common people who make up the human race. What is not the common people is hardly worth considering."

That saying was a reversal of all human ideas since the beginnings of history. Priests, kings, emperors, princes, aristocrats, wealthy merchants—these had always been the people "worth considering." For these privileged classes the common people had always toiled and fought.

Young Rousseau was apprenticed to an engraver in Geneva, but being badly treated he ran away. From the beginning he determined on liberty. He attracted the attention of a certain Madame de Warens, who was working to get converts for the Roman Catholic Church ; and, becoming one of the converts, he was sent to Italy. An interesting thing happened. This lad chose to cross the Alps on foot. It was very significant. In those days wild Nature was hated as much as it is loved to-day. There are advertisements of houses for sale in Yorkshire which give as an advantage that no windows face the moors : that was the general attitude. No artist painted mountains. No tourist went nearer to them than he need in order to pass to the cities of Italy in a carriage. But Rousseau walked. Later on he wrote :

> "It was only in my happy days that I travelled on foot ; it always delighted me. Later, duties, business, luggage, forced me to play the gentleman and to take a carriage ; troubles, worries and boredom entered the carriage with me, and, while before in my travels I only felt the pleasure of travelling, I now only felt the desire to get to my destination."

In that one paragraph we have almost all his philosophy: his passion

for Nature; his preference for a kind of life which does not "play the gentleman"; his love of freedom. Later, when he was one of the most famous men of his time, he tried to find a companion to go with him on a walking tour, but could find nobody. In this matter of what we now call "hiking" he was born too soon.

His vagabond life became full of adventure, some of it rather ugly and mean and shameful, but when he came to write about it in his *Confessions* he told the whole truth. It was not his nature to gloss over his faults; and he says in the first paragraph that he wishes to show a man as he naturally is. He tried being a man-servant; he worked for a time as assistant to a charlatan who pretended to be collecting money for the Holy Sepulchre, until his master was arrested; he taught music, copied music, returned to Madame Warens (whom he treated quite badly); had one period of quiet and meditation in her country house, *Les Charmettes*; went to Paris and struggled along copying music again; had a love affair with a girl called Therèse, and then when he was thirty-eight wrote a novel, *Julia*, or *La Nouvelle Héloise*. It was an immediate success, for it breathed his love of Nature and his love of truth.

After that came the two books which gave to the world those intoxicating ideas about the natural rights of every man. The first was called *Contrat Social* "The Social Contract." In it he analysed the whole question of government: who should control the government, who should benefit by it. His answer was: the common man. He believed that every man, if he were left unspoiled by wrong education and training, was good. That, too, was a new idea. Always before, it had been taken for granted that people were bad, and needed discipline, authority, strict law, to keep society together. Always before, it had been assumed that these laws were to be made by the few people at the top and obeyed by the great mass of the common people. Always before, it had been accepted that men had to be taught right and wrong; so the churches through religion and the state through law arranged what was right and what was wrong, and then enforced obedience. Rousseau saw quite clearly that much which had been taught was based on the privilege and property of the few. He overturned the whole idea. Too violently no doubt, as we realise now when we read his belief that you need only leave everybody to grow up naturally, have as little

government and as few laws as possible, for all to go right. But in his world of universal tyranny and injustice, his revolutionary ideas were thrilling and wonderful. *The Social Contract* became the Bible of the whole revolutionary movement.

Emile, his next book, was a study of the kind of education which he believed was needed if the older kind was to be done away with. Rousseau believed in God, but he did not believe in the Church, and in *Emile* he attacked the Church dogmas. Once again the book became famous as soon as it was written ; but it was seen to be dangerous thinking, and this time he had to fly from France to escape imprisonment for his ideas. For six years he was hounded about Europe. He came to England, but quarrelled with Hume, the man who had invited him here. He was not an easy person to get along with, this highly individual Jean Jacques Rousseau, and some of the great thinkers who admired his thought declared that the man was mad. In 1770 he dared to return to Paris. He was poor, lonely, almost forgotten even by the people who were really greatly influenced by his ideas.

For eight years more he earned a thin living by copying music, and then he died, a " common man " till the last.

But his idea of The Rights of Man had become for ever part of the thought of humankind. Away across the seas in America the democracy of the United States had drawn up the first constitution based on that belief. In his own France, suffering terribly under the old tyrannies of privilege, the new idea was working towards the Revolution. All over Europe his passion for freedom was stirring men from the sleep of centuries. Like a stone dropped in a pool the waves of that idea have spread. To-day the whole world is overwhelmed by them. The liberalism of the nineteenth century, socialism, communism : these are part of that expanding wave. The most dynamic idea in the world to-day is the belief which Jean Jacques Rousseau put into his life and his books : the idea of The Rights of Man.

* * * *

" In the state of nature equality is a real and inviolable fact."

* * *

" Do good without regard to men, and without compulsion from the law."

Jean Jacques Rousseau.

THE RIGHTS OF WOMAN

An Idea of Mary Wollstonecraft

IN the year 1792 there appeared a book by an, at that time, obscure writer named Mary Wollstonecraft. It was called *A Vindication of the Rights of Woman*. Those times, shaken by the French Revolution, were familar enough with talk of "Rights," but this idea of Rights of *Woman* came as a bombshell into the world of thought. Amazement, scorn, shocked horror : all the usual feelings towards a new thing greeted its publication. For more than six thousand years of recorded history, in fact for more than sixty thousand years of human life on earth, women had had their place ; a place subordinate to men. Physically dominated by men (although they did—and still in most parts of the world do—the hardest physical work) ; educated, if at all, in a poorer fashion than men ; paid much worse than men for their work if they happened to be doing anything other than the unpaid job of keeping house ; shut out from doing almost every type of job ; and, of course, given no place in politics or government ; women simply had no rights. Not even the right to possess her own property after she was married, for it was another ninety years before this was granted. Rights for Women, therefore, was a strangely new suggestion in 1792.

There had been brilliant women before Mary Wollstonecraft ; influential women, women who ruled by their beauty, and more rarely by their brains. Sappho, the poetess of Greece ; Hroswitha, the ninth-century nun who wrote her jolly plays ; women like Vittoria Collona, whom Michael Angelo loved ; or that Olympia Morata, who at the age of sixteen was lecturing on philosophy at the University of Ferrara in Italy ; women like Margaret Beaufort of fifteenth-century England, or Madame de Maintenon in seventeenth-century France, who endowed colleges for the education of girls ; Madame Roland, of Revolutionary France, whose salon was a

marvellous political gathering: such rare women had established themselves. But, apart from chance royalty, women simply as women had no kind of position except as the wives or the beloved of men. These great women were brilliant chance products who won a precarious place by their exceptional qualities. Not one of them had ever claimed that any woman, merely as a human being, had rights of her own, until thirty-year-old Mary Wollstonecraft staked their claim. Daniel Defoe, who wrote *Robinson Crusoe*, came very near to it, and it is good to remember what an enlightened person he was.

But we have to realise that it was only thirty years before that Rousseau had written his great book *The Social Contract*, which had made this claim of universal rights for man. He carefully excluded women from this broad claim, deciding that their business in the world and their education therefore was simply to make themselves pleasing to men.

> "The education of women," he wrote, "should always be relative to men, to please, to be useful to us, to make us love and esteem them, to educate us when young, and to take care of us when grown up, to advise, to console us, to render our lives easy and agreeable; these are the duties of women at all times, and what they should be taught in their infancy."

Rousseau, remember, was one of the most broad-minded and enlightened men in the world of his time.

It is against such a background that we have to see Mary Wollstonecraft and her daring new idea. She has told us something about herself and her own life in an early novel, *Mary*. She was born, probably in Hoxton, London, in 1759. Her father wasted a fortune of £10,000, and among Mary's earliest memories is that of lying outside her parent's bedroom door throughout the whole night ready to interfere if her father struck her mother. The family was always on the move; and Mary, with her sensitive nature, was from the beginning noticing the injustice towards the poor, the weak, and especially towards women. As she grew up she began more and more to protect those around her. Her sister Eliza married a violent-tempered man named Bishop, who reduced her to the verge of insanity, until Mary took Eliza away from him and defied him to attempt to take her back—an amazing thing to do in 1783. As the two sisters had no money they started a school, and Mary practised

the advanced ideas she had on education. Her greatest friend, Fanny Blood, had a curious love affair with a man named Skey, and Mary settled it firmly by making them marry when he obtained an appointment in Lisbon, and packing them off there. The affair was not very successful; Fanny became ill, so Mary left her school, went out to Lisbon, and nursed her dying friend. Back in England the school had failed in her absence, Fanny's family and her own were on her hands, and to earn money she began to write. *Thoughts on the Education of Daughters* was her first book. For a time she worked as a governess in Ireland while she wrote *Mary*, then she came back to London and began regular work for a publisher—Johnson—translating, editing, writing. So, step by step, she led on to her great book. It challenged all the ideas of the world on the subject of the treatment of her sex and their place in society. It was a completely new conception. Its appearance marked the coming of all we call Feminism, all the vast Women's Movement, into world affairs. She went right down to the root of things: a woman was simply a human being, and as such had every right to develop herself equally with a man. Education, economics, political rights, marriage rights: in everything woman had Rights of her own instead of mere privileges granted because she was pleasing or useful to men.

Mary Wollstonecraft's own life-story after its publication—her love affair with Mr. Imlay in Paris, her subsequent marriage to the great English reformer, William Godwin, and the birth of her daughter Mary who married the poet Shelley; her death in 1797 when she was still only thirty-eight years old—need not concern us, fascinating though it is. But the seed she started in that book grew into a tree that has covered all the civilised world. More than fifty years afterwards, in 1847, it bore a strange fruit in a pamphlet by Anne Knight demanding Votes for Women. Nearly eighty years after, in 1869, John Stuart Mill put forward the idea in a bill in parliament. Two years later the State of Wyoming in America gave some women votes. But it was not until 1907 that a European country, Finland, gave votes to her women; and Norway followed the next year. These things were tidemarks of the flood which crept up throughout the nineteenth and early twentieth centuries. The political side was but one aspect of it—an aspect which did not triumph here in England until the women had resorted to the des-

perate means of the "Militant Suffragists," had been imprisoned, forcibly fed in prison, and had even died for their cause.

Meantime, in the all-important field of education, this fundamental Right of Women made headway. As far back as 1858 Cheltenham Ladies' College was established under the pioneer, Miss Beale, the forerunner of the many good schools and colleges for girls and women. The battle for equal rights in the universities was a long and arduous one. It was not until after the last war—in 1925, in fact—that Oxford and a very reluctant Cambridge granted degrees to women, although London and some provincial universities had already done so. The story of this struggle for women's education is in itself a fascinating chapter.

That of their demand to enter the professions has proved an even more uphill fight. When Miss Jex-Blake demanded a medical degree and the right to practise as a doctor in 1869 the idea was viewed with horror; and twenty years were to elapse before a woman, Mrs. Scharlieb, received a medical degree. The service of Florence Nightingale, that most determined champion of her sex and its right to work alongside men, should have convinced anybody of the justice of the claim. The fight to practise law, engineering; the claim to equality in the commercial field; the battle for equality of wages everywhere; and more subtly, the right to freedom of spirit socially and to equality under marriage laws and conventions: all this and a thousand other phases of the struggle for Women's Rights have marked the hundred and fifty years since Mary Wollstonecraft issued her pioneer challenge. Great names have followed hers: Jane Addams of America, Ellen Key of Sweden, Mrs. Fawcett of England, Selma Lagerlof. Ibsen shook Europe on the question when he wrote his challenging play, *The Doll's House*, story of the wife who had always been treated as a doll until she revolted and left her husband's house to "live her own life." Shaw took up the cudgels on behalf of women, and his plays were delightfully Feminist.

Hundreds of brilliant women entering every phase of public and educational, commercial, political life as opportunities opened, proved the justice of the rights of women. But the watershed was Mary Wollstonecraft's great book. Before it stretched the untold centuries of women in subjection; after it came the flooding consciousness of this vital new idea. History has yet to show how far those floods will spread.

TRAGEDY AT TOLPUDDLE

The Idea of Trades Unionism

ON 19th March in the year 1834, at Dorchester Assizes, six farm labourers were sentenced to seven years' transportation on the curious charge of "administering an unlawful oath." The sentence was a terrible one, for scarcely any convict who went out to Botany Bay ever returned. Even if they survived the term of prison slavery with its floggings, underfeeding and terrible conditions, there was no arrangement for returning prisoners to England. Many of them became bushrangers ; most of them died before the prison term ended ; some died on the way out in the inhuman convict ships. To these six men it was virtually a death sentence, for they were gentle creatures. Five of the six were local Methodist preachers. One was really suffering in mistake for his brother, whom he was protecting by his silence. We know them now as "The Tolpuddle Martyrs," and that trial and savage sentence little over one hundred years ago is one of the outstanding dramas of the coming of the idea of Trades Unions. To-day in their tiny village of Tolpuddle, you will find a Memorial Gateway with this inscription:

Erected in Honour of the
Faithful and Brave Men of this Village
Who in 1834 so nobly suffered Transportation
in the cause of Liberty, Justice and Righteousness,
and as a Stimulus to our own and Future Generations.

GEORGE LOVELESS
JAMES LOVELESS
JAMES HAMMETT
THOMAS STANDFIELD
JOHN STANDFIELD
JAMES BRINE

The incident was but a part of a movement which was sweeping the country, but it proved to be a final challenge of working men's

right to combine together to try to get better wages or better conditions. These Dorchester farm workers were asking their masters for ten shillings a week instead of the seven which they were getting, a wage which with rising prices of food meant almost starvation for them and their families. Hardly a crime this, as we see things to-day; and indeed not really criminal even in 1834, for the struggle for the right of workmen to combine had already been won legally. But at Tolpuddle the local farmers, the local Squire Frampton, the Lord Lieutenant of the County of Dorset, were diehards, and when they heard that these six men had organised a Grand Lodge at Tolpuddle of the Labourers' Friendly Society, they determined to break it if they could. They appealed to the rather feeble government under Lord Melbourne and that nobleman gave them the hint that a few years before, to put down a naval mutiny at The Nore, an Act had been passed in Parliament forbidding people to bind themselves together with secret oaths.

These Tolpuddle yeomen were simple fellows. They had had quite a little secret ceremony when they established their lodge: masks and swearing on the Bible, and a six-feet-high painted skeleton and wooden battle axes. On that evidence the law closed in upon them, gave four days' notice, and then arrested them; arrayed clever lawyers against them, and imposed the savage sentences; and packed them straight off to Portsmouth where an awful convict ship, already filled with hardened criminals, was almost ready to sail. So they were deported, and apparently the diehards had won this round in the struggle with the Trade Union idea.

It might be well to glance back a few years at the earlier phases of that struggle. It had arisen in the last years of the eighteenth century. It had arisen because of the coming of the machine into industry during those years, and the consequent change of all the conditions of work. For hundreds of years before there had been little change since the days of the Mediæval Guilds, those associations of craftsmen, masters and apprentices, who arranged the wages and conditions in their own trades. In Queen Elizabeth's time a law had been passed called "The Statute of Apprentices," which approximately made these Guild arrangements legal. And for two hundred years that simple method worked well enough.

Then came coal, steam, machinery. No longer the little crafts-

man's workshop, but the first factories. No longer villages and small market towns, but the beginnings of hideous manufacturing towns. In the country, the new machines demanded bigger farms. Land which since feudal times had been the common property of the village people was included in big estates under the new "Enclosure Acts." As Mr. Chesterton wittily puts it :

"The village Green that had got mislaid
Turned up in the Squire's backyard."

Some workpeople in the woollen trade in the West of England, alarmed at the way things were going for them, first joined together to ask the Government to revive that old Act of Elizabeth. The Government appointed a Committee, but when the wool masters opposed the idea of interference, they did no more. Indeed, in 1774, Adam Smith had published a book called *The Wealth of Nations*, which argued that if every individual struggled for wealth for himself without any interference England would inevitably become enormously prosperous and therefore everybody would share the prosperity. "Enlightened selfishness" was to usher in the millenium. A charming theory, but it just did not work so far as the working-people were concerned. The machines threw them out of work, and a new horror came into the world—unemployment. Enlightened selfishness used this to force all the workmen (which included women and children down to the age of five) to take lower wages. So they found themselves with wages at starvation level, or none at all.

Sometimes they revolted by smashing the machines. But gradually the idea arose that they should agree among themselves to refuse altogether to work, and should save co-operatively so that they could exist during these "strikes." They also tried to prevent, by force if necessary, other men doing their jobs during strikes. It meant rioting. Across the Channel the French Revolution had shown the dreadful possibilities of the violence of the people, and the upper classes and the new manufacturing classes here were in terror. Their fear made them tyrants.

In 1799 the master millwrights appealed to the Government for protection against the journeymen, and as a result of the agitation Parliament brought in a law to forbid Combinations of Workmen. Apparently enlightened selfishness was only to work one way, for

the bill passed. Even men like Wilberforce, who freed the Negro slaves, wanted it, so fearful were the governing classes of mob rule in those days following the Terror of the French Revolution and the rise of Napoleon. There were protests against this " Combination Act," and Sheridan got a new and more lenient one passed soon afterwards. But the new Act remained a dead letter, and conviction after conviction was made of workmen who attempted to strike. Judges and magistrates were all on the side of the employers. Hear one of them speaking as he sentences nineteen printers of *The Times* newspaper who left their work :

> " The frequency of such crimes among men of your class of life, and their tendency to ruin the fortunes of those employers which gratitude and self-interest should induce you to support, demand that a severe example be made. No symptom of contrition on your part has yet appeared."

In that atmosphere of war between workers and masters, with the law on the side of the masters, this idea of Trades Unions struggled on. It became secret, underground. New members were sworn in with childish ritual : officers in surplices, drawn swords, battle-axes and skeletons being used as stage properties to impress secrecy and the terror of the occasion.

For twenty-five years this guerilla warfare continued ; but the idea of Trades Unions had come to stay. William Cobbett went about the country on his famous " Rural Rides " and reported the dreadful conditions of poverty in his paper, *The Political Register.* Francis Place, a breeches maker from the Strand, and his friend in Parliament, Joseph Hume, worked for repeal of the Combination Act. And in 1825 repealed it was.

Thus, when nine years later those men at Tolpuddle joined together to form a local Lodge of the Labourers' Friendly Society they were within their legal rights. They were tripped up, as we have seen, by an Act which only concerned the curious play-acting of their admission. But they were courageous and determined men, and they stood for their new great idea.

> " We raise the watchword ' Liberty.'
> We will, we will, we will be free."

cried George Loveless. It was bad poetry, but good doctrine. And because these men were speaking and acting for an idea which was

part of the tide of progress their martyrdom roused all England. Everywhere the workers rose in protest. Robert Owen, that capitalist turned reformer, led a hundred thousand men to demonstrate to Parliament. It took two years of agitation before the suffering men were pardoned, and for two years more they were cheated of their liberty. But the Tolpuddle Martyrs triumphed: six poor men who had faith in an idea; six men who had the courage to join together against all the tyranny of the realm; six men who dared.

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THE HYMN OF FREEDOM

"God is our Guide! From field, from wave,
From plough, from anvil, and from loom,
We come, our country's rights to save,
And speak the tyrant faction's doom;
We raise the watchword 'Liberty.'
We will, we will, we will be free.

God is our Guide! No swords we draw,
We kindle not war's battle fires,
By reason, union, justice, law,
We claim the birthright of our sires;
We raise the watchword 'Liberty.'
We will, we will, we will be free."

George Loveless.

EVOLUTION EXPLAINS

The Ideas of Darwin, Wallace, Huxley

TO-DAY practically everybody accepts the idea of evolution. We may not quite know what it means; and if asked, some would probably get little nearer the truth than that schoolboy composition on the subject consisting of one sentence: "Mr. Darwin said that the first monkey was a kind of jelly." Which might be more helpful if less learned than that exact definition by the philosopher, Herbert Spencer:

> "Evolution is an integration of matter and concomitant dissipation of motion; during which the matter passes from an indefinite incoherent homogeneity to a definite coherent heterogeneity, and during which the retained motion undergoes a parallel transformation."

Perhaps philosophers have to write like that. Between these two extremes most of us know that sometime in the middle of the nineteenth century Charles Darwin published his great book, *The Origin of Species*, challenging the orthodox idea of his day with his theory that the myriad different forms of life had come into existence in the course of millions of years because the kinds most fitted to survive in the struggle for food and against climate and enemies had perpetuated themselves. Man was but one of these kinds and had evolved with the rest, but he had been able to go much further, far, far beyond even the great apes who were the nearest approach to him.

The story of the coming of that idea as a popular and accepted explanation of the beginnings and subsequent changes in the life story of men and animals was the occasion of one of those amazing advances in human knowledge which now and again stir the world. Charles Darwin, Alfred Russel Wallace, Thomas Huxley: those

are the three names we most associate with that advance; but it was Darwin's book which created the sensation.

Actually this idea of evolution (the word means unrolling or opening out) was no new one. It was at last as old as the Greeks, and throughout the ages a few fine minds had dimly seen its truth. Goethe, scientist as well as poet, had believed in it during the preceding century ; Darwin's own grandfather, Erasmus Darwin, had been a profound evolutionist; Lamarck, the French zoologist, had published a book with a theory of evolution in 1809 ; and a score of other men had supported the broad idea.

Against this we have to remember the solid body of opposition. The Church in particular was still committed to the literal interpretation of the Bible, and the Bible said clearly that mankind and all other types of animal and plant were created by special acts of God in six days about six thousand years ago. The universities of Oxford and Cambridge were so completely dominated by the orthodox Church that until 1854 no dissenter of any kind was permitted to go to either ; no teaching post was given to other than Church of England communicants until after 1878. They made no provision for science, and had no laboratories. A student who dared to question the strict idea of creation as stated in Genesis would be informed that he should accept the word of a communicant of the Church of England. That state of things was fairly general not only in England but on the Continent. Haeckel in Germany fought the same battle as Darwin, Wallace and Huxley did here ; and as late as 1877 the Prussian Minister of Education forbade the teaching of evolution in the schools. When these diehards of the old orthodoxy were confronted with the problem of the fossils of extinct animals in the rocks, they first asserted that they were the remains of species of animals which had also been specially created on the fifth day. Finally somebody suggested that God had embedded these fossils into the rocks to test the faith of nineteenth-century mankind, and orthodoxy accepted this view if it found itself at all embarrassed by the geological evidence. There is a wonderful account of this fight between the old idea and the new in Edmund Gosse's book *Father and Son*, for the elder Gosse was a champion of Genesis, and when his greatest friend, Charles Kingsley, accepted the evolutionary theory Gosse refused to see him again. It is fair to say that in the 1860's

this was the most controversial question in the world. Charles Darwin, who was primarily responsible for this avalanche, had had no idea of attacking established religion. A semi-invalid, a recluse living in his house at Downe in Kent, he was concerned only with science. As an ardent deist he felt that the miracle of evolution, controlling life on the planet through millions of years, was a more sublime method of creation than the accepted scriptural one.

As a young man of twenty-two he had seized an opportunity to go on a voyage as a naturalist to the Pacific on the Government research ship H.M.S. *Beagle*. That was in 1831. Since that time he had laboriously and with infinite patience collected facts of botany, zoology and geology to discover the truth about evolution. On that voyage he took two books, Milton's *Paradise Lost* and Charles Lyell's *Principles of Geology*, a work which threw overboard the old ideas about the age of the earth, and was one of the earliest to point out the significance of the fossils. The stage was set for the conflict of thirty years later. Throughout the five years of the *Beagle's* journeying, Darwin collected facts and arranged them in order. When he returned and retired to Downe it was to continue a life of unbroken scientific research. It is noteworthy that when he wanted to write a book about earthworms he covered a portion of a field with chalk, and waited thirty years to see how far the worms would take it down into the soil. Everything he did was on that pattern of infinite patience and waiting for Nature to reveal her secrets.

In 1844 he wrote : " I am almost convinced that species are not immutable. It is like confessing a murder."

But for fifteen years more he studied his problem before he published his book. In the Pacific islands he had collected enough facts to establish his belief that animals and birds and plants did gradually change. On one island the mocking thrush was different from the mocking thrush on another distant island, yet they obviously had some common ancestor. But *why* were they different ? It was that question which Darwin wanted to solve. He got his clue when he read the famous book by Malthus on *Population*, for the Rev. T. R. Malthus was very worried about the increase of the population in the world, and foresaw a time when there would be more people than could be fed. He was quite wrong, but Darwin saw an explanation here to his problem. He believed that the struggle for existence

was Nature's way of causing evolution. Those animals born best fitted to survive among all their kind because they had some physical characteristic which ensured them food or protection, *did* survive. They mated and bred offspring who had the characteristic by heredity from both parents, and so gradually the chance members became the type, and all others died out. That, said Darwin, was Nature's method of changing. That was the secret of evolution.

Just when he was putting the finishing touches to his book he received for criticism a manuscipt from a young scientist who was working in Malay, Alfred Russel Wallace. It was called *The Struggle for Existence*, and had reached the same conclusions as his own, by the same road ! Darwin, with the nobility of mind which always characterised him, arranged that this yet unknown man should share in the honour of the discovery, and when in 1858 a paper first putting forth the theory was read at the important Linnean Society it was in the name of both men.

The next year Darwin published *The Origin of Species*. It was an immediate success, and caused an astounding furore. It became a best seller. On the day of publication an edition was exhausted. In one way England happened to be ready for its doctrine, for Britain was at the height of her commercial success which arose from the Industrial Revolution, and this idea that Nature arranged evolution by means of unlimited competition and that the fittest survived was a pleasant one to the successful British. On the other hand, as we have seen, came the bitter opposition of the churchmen. It was at this point that Thomas Henry Huxley, another brilliant young scientist, entered the fray. Darwin, a sick man always though he lived to be seventy-three, remained a comparative recluse at Downe. Huxley led a positive campaign for the new idea throughout the country, writing, lecturing—largely to working men, which was itself an innovation—challenging the orthodox. There was one tremendous scene in 1860 when, at the annual meeting of the British Association, Bishop Wilberforce of Oxford rather scurrilously attacked the new theory, and Huxley with furious wit, if not with politeness, asserted in answer to a challenge that he would rather be related to the apes than to the bishop. Darwin called Huxley his "bulldog," and certainly he growled and barked to no small purpose in those days of wild controversy. It all flared up again

later when Darwin published his further book, *The Descent of Man,* for here he boldly associated our origins with some common ancestor to ourselves and the great apes. But one by one the best minds of the time came over to this idea. Churchmen, scientists, philosophers, thinkers of all kinds accepted the broad fact of the long history of the creatures, including man. Out of that acceptance came new branches of science, sociology, anthropology, modern psychology; new light on biology, botany, zoology; out of it blossomed a vaster and more united vision of our world and all created things. Strangest of all, out of it came new knowledge which has since practically disproved Darwin's original theory, so that to-day Darwin stands as a milestone which we have passed on our journey along the road of human knowledge—that marvellous highway which seems to have no end.

* * *

"Thus from the war of Nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows. There is grandeur in this view of life, with its several powers having been originally breathed by the Creator into a few forms or into one.

"Whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved."

Charles Darwin.

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"We have not the slightest objection to believing anything, if you will give us good grounds for belief; but, if you cannot, we must respectfully refuse. No good ever comes of falsehood."

Alfred Russel Wallace.

MANKIND *VERSUS* MICROBE

The Idea of Pasteur and Koch

AWAY back in the early sixteenth century an Italian physician, faced with the terrible fact of recurring disease epidemics, made a suggestion as to their cause which sounded merely fantastic to his fellows. It may have seemed a trifle fantastic to Fracastorius himself for he first launched it in the form of a poem about imaginary shepherds, and in that Arcadian story he told how illness was conveyed from one person to another in the form of minute "seeds," seeds of disease and death. One of his similes was that these grew and affected the whole body like the fermentation in wine. It was an age of curious ideas, and even when Fracastorius put his theory into the more definite form of a learned *Treatise on Contagion* nobody took any notice.

More than a hundred years later, in the seventeenth century, Thomas Sydenham, an English doctor, took up this idea of "infectious particles" as the cause of disease; and about the same time Kircher, a German, began to use a microscope to examine the blood of patients in a search for those particles, and pronounced them "living." And there again the matter rested for another hundred and eighty years.

In the middle of the nineteenth century the quest of the germ began again; and this time it was carried to a conclusion which revolutionised humanity's ideas about disease. Louis Pasteur in France and Robert Koch in Germany were the leaders of the new campaign; whilst Joseph von Pettenkofer of Munich rallied to the standard with his cry for Hygiene, and Lister in Scotland applied the theory to surgery.

Louis Pasteur was born in 1822. His first scientific studies were in connection with crystals, but early in his life he turned to the scientific problem of fermentation. He was soon involved in a great

controversy with the scientists of his day led by Liebig, for these men held the old idea that life somehow generated itself. Were his studies truly "connected with the impenetrable mystery of life and death," as he wrote wonderingly at the beginning of them ? His opportunity came when he was appointed to a professorship at Lille *in the heart of the wine country, for here it was that a wine merchant,* the father of one of his pupils, asked his help concerning the souring of his wine stocks.

Under Pasteur's microscope the fermenting wine yielded its secret : he found that it was alive with tiny organisms. From that time Pasteur's life was more than ever consecrated to a battle with bacteria. He discovered that they would not live at high temperatures, and the process which even to-day we call "pasteurisation" was his solution to the problem : first heat the wine to the point where these bacteria died, and then seal it from the air. For the second important phase of Pasteur's discovery was that the dust of the air was the carrier of these germs.

He proved it fascinatingly by making long test tubes of twisted glass so that as the air went into them the dust particles were gathered on the surfaces, and so did not reach the liquid at the bottom. He proved it again by exposing liquids to the dust-laden air of Paris, and the same liquids to the pure air on alpine glaciers. Always the results justified his theory : that dust in the air conveyed existing live bodies which, under suitable conditions, multiplied and set up the putrescence.

In 1863 he told the French king, Louis Philippe, that it was his ambition to track down the sources of "contagious and putrid diseases." It is well to remember that this man was a chemist not a doctor, and all his early work was connected with questions of manufacture. From wine he turned to silkworms, for the silk industry was being ruined by a disease on the worms. Pasteur failed at first ; but he persevered, and discovered, as he had hoped, that the disease was caused by yet another of these bacteria which, he was convinced, swarmed everywhere waiting conditions favourable for their swift generation.

The years 1865 and 1866 were sad times for him : his father and then two of his own children died in quick succession ; he was being violently attacked by the scientists ; his experiment with the

silkworms seemed a failure ; then he himself was stricken with paralysis. But the secret of Nature which Pasteur had revealed was being tracked down by other minds. Not the least exciting—or excitable—was Joseph von Pettenkofer. He has been called the Father of Hygiene, for such was his enthusiasm. A great moment came to him when, in 1854, Munich was holding an Exhibition in the Glass Palace following our own Exhibition at the Crystal Palace in Hyde Park in London. Suddenly in the town full of visitors came the dread cry of cholera, and death raged everywhere. Pettenkofer, with a theory which was partly wrong but which showed the way to others, was himself something of a hero for his own ideas, for at one point of his experiments, in order to prove that germs are not dangerous unless they have a favourable breeding-place, he swallowed a culture of several million cholera bacteria, with no ill effect.

The Franco-Prussian War of 1870 brought its own evidence for the truth of the theory. Already Lister had plunged into his battle for antiseptic surgery, and the Germans went into the war equipped with arrangements for treating their wounded in this way, with marvellous results. A year or so later Lister wrote his famous letter to Pasteur acknowledging his debt to the Frenchman's discoveries ; and Pasteur, at this time fighting a tremendous struggle against the orthodox members of the French Academy of Medicine to which he had been elected, was greatly encouraged by the surgeon's tribute.

The next phase was the triumph over anthrax, that dreadful disease of sheep and cattle which was ruining the farmers of France so that they called in Pasteur to deliver them. Unknown to him, Robert Koch in his little township of Wollstein in Germany had met this challenge and was working on his lines. Under his microscope Koch watched the long thin organisms, which seemed to live only in the infected blood of animals with anthrax, divide, grow, divide again, multiply into sixteen million germs in eight hours according to his calculations. This ordinary medical practitioner, using a sterilised home-made wooden splinter instead of a hypodermic syringe, experimented on mice and produced the deadly disease. He went to Breslau and introduced his ideas to Professor Cohn at the university there, and immediately his theories found acceptance under the patronage of that famous botanist. Koch was given a laboratory in Berlin, and began that series of amazing discoveries of the separate

germs: the anthrax germ, the cholera, the typhoid, bubonic plague, tuberculosis. He it was who isolated the tiny bacillus shaped like a comma which he proved to be the cause of cholera. All over the world Robert Koch pursued his discoveries and his fight against germs. In Egypt and India he fought cholera; on an island in the Adriatic he vanquished malaria; on another in the midst of Lake Victoria Nyanza, he investigated the deadly tsetse-fly, carrier of sleeping sickness. The Japanese built a temple over a lock of the hair of this man whose work on cholera saved millions of Japanese lives.

Meantime Pasteur continued his own brilliant investigations. One of his triumphs was in 1881 when he was engaged on anthrax at a village near Chartres. He had found accidentally, while working on an epidemic of chicken-cholera which had been devastating a part of France, that some fowls inoculated with some old germs did not die, and that when they had later been inoculated with strong germs they remained untouched. It gave him the clue to the re-discovery of vaccination which Jenner had advocated and practised in England nearly a hundred years before. So at Pouilly-le-Fort he daringly accepted a challenge to vaccinate twenty-five of fifty sheep with a weak anthrax germ, and then to give the whole flock anthrax. The experiment succeeded exactly as Pasteur believed. The twenty-five inoculated sheep lived. The other twenty-five died. He had found one way of dealing with the terrible disease.

Not less exciting was his daring inoculation of a lad who had been bitten by a mad dog. Hydrophobia was one of the horrors of humankind until that day; and Pasteur, risking all in this experiment with a terrible disease, again showed the way out. That was in 1885. Three years later the Pasteur Institute in Paris was opened, that vast laboratory where his work could be continued under perfect conditions by numbers of men and women trained in his theories and methods.

To-day we no longer doubt. The discovery which is chiefly associated with his name, but which had smouldered for hundreds of years and then blazed up in the middle of last century in the patient hands of Pasteur himself, of Pettenkofer, Lister, and Robert Koch; the idea which has saved millions upon millions of lives, and opened unending vistas in the arts of medicine: that remains established among the scientific certainties.

MAKING SURGERY SAFE

The Idea of Lister and Semmelweis

A FRENCH chemist in Lille studying why wine and beer turned bad in the vats; an English surgeon in Glasgow desperately fighting to save his patients from the awful scourges of disease as wounds or the incisions from their operations became septic; a Hungarian doctor in Vienna equally desperate at the terrible death-roll of the mothers after the children were born in his maternity hospital. Pasteur; Lister; Semmelweis.

In the early 1860s these three men knew nothing of each other, but each of them was working towards a discovery which saved millions of lives, revolutionised surgery, gave vast results in matters of our food, and supplied the clue to hundreds of diseases. That discovery was germs, microbes, the minute organisms which could only be seen through the most powerful microscopes, but which bred a life of their own able to destroy the living tissues infected by them.

It was in surgery that the most spectacular results of that discovery were obtained, and it was there that the battle between the new idea and the old prejudices was fought out most dramatically. Its coming into that field changed the whole conditions under which operations were performed, and so enormously extended its possibilities that we reckon the art in two eras: one covering the history of mankind from earliest times to this time of Lister; the other, the period since. For in ancient India, in Egypt, Greece and Rome surgery was practised, and the instruments and knowledge were already remarkable. If it stagnated under mediæval influences, it revived again under such men as Paracelsus in the sixteenth century, and moved steadily forward through the seventeenth and eighteenth centuries as human anatomy and physiology yielded their secrets to the scientists. In the nineteenth century one great discovery came

to the aid of the surgeon when James Young Simpson experimented with anæsthetics, and so gave him time to perform his delicate work on patients unconscious of pain.

But one terrible thing remained wrong.

In every hospital whether from some original injury or from the surgeon's knife, wounds became inflamed, turned gangrenous, or developed some similar terrible degeneration, and in a few days the patient died as the whole blood stream became poisoned. Terrible epidemics of this "Hospitalism," as they called it, would sweep through the wards. Often the authorities would deliberately close a hospital for a time to try to stamp out the plague. But always it returned. Even the simplest operation—the removal of a single joint of a finger, the lancing of an abscess—would prove fatal; and no operation was possible on the delicate parts of the human body, for almost inevitably they became infected, and however skilful the surgeon had been the patient died.

In a great Glasgow hospital a brilliant young surgeon named Joseph Lister fought this evil. He was an earnest young man, son of a Quaker family, and he had consecrated his life to this task of making surgery safe. Once he said, concerning a wound that was healing healthily: "It is the main object of my life to find out how to procure such a result in all wounds." He had already set his feet along the right track by studying inflammation, making strange experiments with the foot of a frog and the wing of a bat under his microscope.

Said another great scientist: "In the field of observation chance only favours the mind which is prepared."

Lister's mind was marvellously prepared. Other men accepted defeat; they thought vaguely that there were gases in the air which caused wounds to become septic. Lister's own teacher had stated that surgery had reached finality; but Lister worked on. He suspected that there were minute organisms which entered wounds and set up their own life-destroying life there, degenerating human tissue as the greenfly will destroy the rose. He began his experiments for some substance which would destroy this lower form of life, or build some barrier between it and the open wound.

He found what he wanted in a powerful disinfectant, a by-product of coal-tar, which he learned that the authorities at Carlisle were

using on their sewage. It was called carbolic. Lister introduced it into the hospital wards, into the operating room, into his surgical bandages. He dipped his instruments in it, and his swabs were rinsed in it. He even sprayed the air around with a fine mist of carbolic while he performed his operations. Joseph Lister had introduced antiseptic surgery.

It is fascinating that away in his maternity hospital in Vienna, Dr. Semmelweis had reached the same conclusion. There, with greater violence even than in Britain, the thing flared into an unreasoned persecution of the pioneer by the old traditional men. Semmelweis published his idea of antiseptics ; he was persecuted, reviled, laughed at, and dismissed from his post for advocating this new method. He was driven temporarily insane ; but recovering, continued his experiments in private. In one of them he contracted the blood-poisoning he was seeking to eliminate and died : a martyr to truth, a prophet of progress who gave his life in a great cause.

Over in France the chemist, Louis Pasteur, had just published his studies of the cause of fermentation in wines. He demonstrated that the dust of the air contained minute organisms which increased and multiplied themselves in a kind of fungus when they came into contact with the right conditions. He conducted the most careful experiments, and demonstrated that fermentation which took place in the dust-laden air of Paris did not do so in the pure glacial air on the high Alps.

When Lister read of these experiments he saw that in them, as he had long suspected, lay the final clue to his own problem. It was not until years afterwards that he heard of Semmelweis, but already an opposition similar to that which broke the Hungarian was growing here. Simpson himself, who as the pioneer of anæsthetics had suffered a similar persecution for his own innovations, led the attack; and soon the old brigade of the medical men were bringing all their weapons of ridicule and wild accusation to bear on the " Spray and Gauze " school, as they called Lister's methods. One of the ugliest fights of Lister's career was with the Glasgow Infirmary where he had started his practice of antiseptic surgery, for they bitterly resented an attack upon the position of their buildings which happened to be built a few feet above a cholera pit where hundreds of bodies were still decaying !

But Lister worked on. For nine months there were no cases of the dreaded " Hospitalism " in the wards under his control. Terrible fractures and gaping wounds, which inevitably would have become septic under the old treatment, healed themselves when treated by his antiseptics and given their barrier of carbolic against the infected air. Operations performed by his sterilised instruments and cleaned with his sterilised swabs left cuts which naturally healed, when under the old system they would have broken down into gangrene or some other of the dread hospital diseases. Childbirth lost one part of its terrors, for the horror of septic conditions starting up after the child was born became almost eliminated. It was the fight of a new idea against the old, and gradually the new won out.

On the Continent, in Copenhagen and Leipzig, in Munich, and under the great doctor Volkmann at Halle, the idea of antiseptics expanded to that even greater one of creating operating theatres and operating conditions which give no place at all for microbes. The antiseptics of Lister evolved into the aseptics of modern surgery. Steam-sterilised overalls, caps, masks and rubber gloves on doctors and nurses ; perfectly sterilised instruments, operating tables, and theatres, took the place of the old germ-infected operating rooms, doctors in garments bloodstained from a hundred operations, instruments which carried bacteria from one patient's festering wound to the next, and sponges which had been perfunctorily rinsed out in a little warm water. In the wards, too, if absolute scientific aseptic conditions were impossible, antiseptic ones were insisted upon.

Microbes, germs : these enemies of mankind had at last been discovered. By the quiet persistence of the truth-seekers, working upstream against the flow of ancient prejudice, mankind has entered into new realms of health, and the borderlines of death have been pressed farther back.

* * *

" A scientist's life is his work."

* *

" A feeling heart is the first requisite of a surgeon."

Joseph Lister.

SIGNALS ROUND the WORLD

Samuel Morse and the Telegraph

"DOT-DOT-DOT ; dash-dash-dash ; dot-dot-dot."
"S.O.S."

The morse code ; universal language of the telegraph and allied methods of sending messages across the world. May 24th, 1944, is the centenary of the transmission of the first message by telegraph, the triumph of that brilliant man who had worked for twelve years to bring to fruition his idea, the great moment in the life of the American, Samuel Finlay Breese Morse. How many of us know that story ?

The urge to signal across distance was one of humanity's oldest needs. The drum taps or smoke signals of savage peoples ; beacon fires flaming their warning from hilltop to hilltop ; semaphore signals by flashed lights or reflected sunlight : for century after century man sought the means of distant communication. In the eighteenth century, the father and two brothers of Maria Edgeworth, the novelist, experimented with the use of the sails of windmills—the position of the sails representing letters—and later with pointers erected on high masts. After the Edgeworths came the efforts of a Mr. Gamble, with a strange machine of holed lathes ; and then the things like railway signals invented by Home Popham, which the Admiralty used to signal the arrival and departure of ships. All these crude schemes, however, necessitated the use of high ground for visibility. The various Telegraph Hills between London and Portsmouth are still the witness of Popham's idea.

Long before, in 1632, that amazing man Galileo had seen that there were possibilities in the use of the magnetic needle, but nothing was done until well into the nineteenth century when the way had been prepared by the invention of the electro-magnet by William Sturgeon. That was in 1825 ; and a few years afterwards, from a

discussion about the electro-magnet, the idea was born which gave us the telegraph.

It was on board the ship *Sully* sailing from France to New York, and one of the men talking was an artist who was returning to his native country after a period of study in Europe. Samuel Finlay Breese Morse had already had the beginning of a fine career as an artist, for when he was thirty-five he had been appointed Professor of Design at New York University. The trip to Europe to gain deeper knowledge of his art was typical of the man, for it had meant burning his boards. So as he sat after dinner chatting with his fellow-passengers be believed that he was returning to attempt fresh fields in sculpture and portraiture, not realising that the conversation of that evening would change his whole life. Realising still less that it would change the life of the world.

A Dr. Jackson was telling of the wonders of the electro-magnet, and how an electric current passing through the wire coiled around the iron magnetised it.

"And how long does the current take to travel through the wire?" aksed Morse.

"It is instantaneous."

Jackson went on to recall how Benjamin Franklin, that fascinating experimenter, had proved this by stretching a wire across the river at Philadelphia and touching it with electric force at one end to demonstrate that the spark immediately flashed from the opposite bank. Somewhere in the artist's mind, as he heard that story, a thought was born. He had seen how the Italian troops had been using semaphore signals in their war manœuvres, and the idea of using an electric spark to carry messages took dim shape. Down in his cabin strange drawings and diagrams began to take shape in his sketch-book.

When he left the ship, Morse told the captain that if ever he heard of something called a telegraph being invented he could remember that the discovery was made on board the *Sully*.

Back in New York he turned from art to this compelling idea. If he painted at all, or taught pupils, it was merely to get enough money to keep his experiment going. One does not become, or ever remain, a successful artist on those terms. Soon Morse was miserably poor, living on tea and biscuits in one room, struggling

as a private teacher, and working, working at his invention. The material for the model he was making he gathered from where he could pick it up : parts of an old picture frame, pieces of iron from rubbish bins, wire from anywhere, the wheels of a worn-out clock. There is a story that once he was so desperately in need that he asked a pupil when he would be paid for his tuition, and when the lad replied, " Next week," Morse said : " I shall be dead from starvation by then."

So for two years he struggled on. At last his model was completed, and Morse took it to Washington to put the idea before Congress, asking for a grant of 30,000 dollars to build the first line from Baltimore to Washington. The machine embodied the principle he had dreamed abroad the ship ; a key touched at one end of a wire, the touch conveyed by electricity to the other, a code of letters arranged on a simple system of compound dots and dashes. So easy : but the potentialities were enormous.

Then Morse waited : days, weeks, months.

> " I find myself," he wrote during that time, " without sympathy or help from anyone. For nearly two years I have given all my time and scanty means, denying myself all pleasure and even necessary food. I am crushed. Unless I have the means from some source, I shall be compelled to give up. Nothing but the knowledge that I have an invention which is to contribute to the happiness of millions has sustained me."

In March, 1843, he had less than one dollar left. Congress was drawing to the end of its session, and still nothing had been done. Then, actually during the last hour of its sitting, it passed a bill to grant the money.

Immediately Morse began the work of erecting the first telegraph between the capital and Baltimore, forty miles away. On the 24th May, 1844, the last wire was in place ; his friend and assistant, Alfred Vail, waited with a group at the Washington end. Morse stood at the machine, ready to touch the key, but his overwrought nerves took all words from him.

" What shall I say ? " he asked those around.

A girl standing by suggested the message :

" What God hath wrought."

" Dot-dash-dash ; dot-dot-dot-dot ; dot-dash ; dash."

Swiftly the key tapped, and the first telegraphic message flashed across the wires.

For two days the significance of that event did not dawn upon the public. Then a Convention of the Democratic Party in Washington elected as the new Vice-President Silas Wright, a Baltimore man. Vail telegraphed to Morse ; Morse informed Wright ; Wright declined ; Morse wired back, and within minutes the Convention was told. The part the telegraph would play in human affairs was no longer in doubt. The once poor and neglected inventor became world famous. Kings, queens, emperors, loaded him with honours and titles ; ten European countries gave him a joint gift of money.

It was not there, however, that the reward lay for such a practical dreamer as Samuel Morse. Infinitely more important was the fact that the magic wires spread in a vast network of communication across the countries of the world. Ten years after the first line had been made, Cyrus Field added to the triumph of the telegraph when he heard that a cable was being laid across New York Harbour, and forthwith saw no reason why a cable should not link America with Europe across the bottom of the Atlantic. That again was a struggle ; and the story of the laying of the first trans-Atlantic cable by the *Great Eastern*, the attempts, failures, disappointments as the thin strand of seven fine copper wires broke again and again, is yet another record of perseverance and heroic effort. But on the 17th August, 1858, the success of the land wire was repeated.

> Europe and America are united by telegraph. Glory to God in the highest, on earth peace, goodwill towards men."

That was the first trans-Atlantic cablegram, the new child of Morse's daring dream ; and if to-day the telegraph is becoming superseded by greater marvels of human intercourse across the world we will hope that it is still in the spirit of those two famous messages.

* * *

" The telegraph is a powerful advocate for universal peace. Not that of itself it can command a ' Peace, be still ' to the angry waves of human passions, but that by its rapid interchange of thought and opinion it gives the opportunity of explanation for acts and laws which might create doubt and suspicion."

Samuel Finlay Breese Morse.

DISTANT VOICE

Alexander Bell and the Telephone

"NUMBER, please!"

More than thirty-five million telephones enable mankind to speak across space, from room to room, town to town, country to country, continent to continent. We have indeed grown so used to this servant of human communication that it is now all but impossible to consider a world without its aid. Yet it was less than seventy years ago when in an apartment house in Boston, U.S.A., the first voice sounded over an arrangement of diaphragm, electric wires, and receiver.

"Mr. Watson, come here! I want you."

It was not an inspired utterance, but Alexander Graham Bell, who was born in Scotland but went to America in his early twenties, made history on that March day in 1876.

This idea of using the scientific fact of vibration to convey sounds along wires had tantalised a number of minds before Bell brought it to practical use. Helmholtz, that brilliant German descendant of William Penn the Quaker, had played with it in his laboratory in Heidelberg, using two cups and a wire stretched between them, and then had turned to research upon Optics and abandoned his experiment. But in his great book, *Sensations of Tone*, he had dealt afresh with the subject, and that book was to prove one of the sources of inspiration to Bell. Charles Wheatstone, whom telegraphy claimed for its own, had as early as 1821 experimented with a queer instrument which he called "The enchanted lyre" using the same principle to convey musical sounds. Philip Reis, another German, had made an instrument out of such mundane material as the bung of a beer barrel, over which a sausage skin was stretched as a diaphragm, with a piece of platinum attached to the skin, which created and broke an electric current as the skin vibrated to the sound waves. His receiver de-

pended upon a knitting-needle which took the current and created the vibrations at its end. He obtained thus some musical notes, and even some vowel sounds, but never carried it as far as human speech. Charles Bourseul, a Frenchman, tried also to make an instrument, but abandoned the attempt ; and Elisha Gray, an American, filed a patent only a few hours after Bell had filed his. As so often happens, this idea was " in the air " throughout the middle of the nineteenth century ; but the honour of effectively bringing it to earth must go to Alexander Bell.

His approach was a particularly interesting one. His father in Edinburgh had devoted himself to the task of helping the deaf to speak by means of lip-reading and the vibrations of the throat. His son helped him in this, but being threatened with consumption when he was about twenty-three years old was sent to America for the sake of the climate. There he continued his father's work and his research. His enthusiasm was for an instrument which would make sound visible. A vibrating disc, a carefully adjusted reed attached to it, the consequent scratches on smoked glass when sound set the reed moving : thus he experimented in his search for visible speech. In those first days he had his speech school in Boston, and, to fill his leisure, his dreams of helping his deaf pupils. Two of the pupils had wealthy fathers : Thomas Sanders and Gardner Hubbard ; and they interested themselves in the young man's ideas.

Then he contacted the young electrician, Thomas Watson, and called in the aid of electricity to create his instrument. But, as dreams are wont to do, Bell's dream changed its form. Soon it was not visible signs which he was trying to produce at the receiving end of his instrument, but audible sounds. He read Helmholtz's book, and he and Watson worked on for years trying to find just the way this thing could be done. They tried every form and thickness of disc, all types of writing, all manner of variation upon the original crude idea. Bell spent all he had on the experiments, and one day in the poor apartment house where they lived and worked Watson rushed up the two flights of stairs to the room where Bell was and told him that he had heard his voice.

" I almost heard what you said."

So the work went on until that day in 1876 when the simple message spelled real achievement: no longer "almost" but absolute.

On his twenty-ninth birthday Alexander Bell obtained his patent. "The most valuable single patent ever issued" it has been called. But this professor of speech-training with his queer instrument and his right to use it was still an unknown and neglected man. How was this telephone to be made known?

Hubbard and Sanders pressed him to show the instrument at the Centennial Exhibition at Philadelphia that year, and thither he repaired, set up his small exhibition stall, hoped that the public and the judges would thrill to this thing he had done. The enormous crowds eddied around with hardly a glance at the shy young man at his table. Sunday was the great day of the exhibition, and Bell's luck changed. The authorities were particularly *en fête* that day for the visit of Dom Pedro de Alcantara, Emperor of Brazil; and as the great man made his triumphant progress he saw Bell, remembered with delight a visit to the deaf school in Boston, greeted him heartily, and demanded demonstration of the instrument.

"My God, it speaks!"

The Emperor's ejaculation was enough. Lord Kelvin, the great English scientist, and his wife were drawn into that vortex of excitement. It is recorded that they rushed from end to end of the great hall talking and listening with the aid of this invention. That few minutes of chance limelight established Bell's fame and the success of his work. From that moment the telephone has woven its vast network of communication about the globe. True, the British Government in 1877 refused a demonstration of the instrument, but it was a temporary hesitation, and that same year the Continent was invaded when telephonic communication was set up between a number of German villages. Interestingly, too, Queen Alexandra, who was then Princess of Wales, had the telephone established between her rooms and her children's nursery, and so led a fashion in England. Perhaps it is worthy of record that in 1879 George Bernard Shaw, as one of his earliest jobs when he came to London, canvassed for subscribers to the telephone. Invention upon invention has brought that first instrument which created its newspaper sensation at the Philadelphia Exhibition to the amazing telephonic system of our own day, with its dialling, its vast exchanges, its ramifications across the world, its millions upon millions of instruments and subscribers. Edison produced the carbon transmitter; David Hughes

gave us the microphone ; de Moncel and Clerac of France, Francis Blake and that scientific curate, the Rev. Henry Hunnings, evolved the transmitter ; a dozen others built on the foundations which Bell laid. But the honour remains with this man who, starting from the study of the delicate vibration of the bones of the human ear, created this ear of the listening world ; and when Alexander Graham Bell died in 1922 the seventeen million telephones in America and Canada remained silent for the space of a minute in honour of this dreamer who brought his dream to reality.

* * *

" Don't keep forever on the public road, going only where others have gone, and following after one another like a flock of sheep. Leave the beaten track occasionally and dive into the woods. Every time you do so you will be certain to see something that you have never seen before. Of course it will be a little thing, but do not ignore it. Follow it up, explore all around it ; one discovery will lead to another, and before you know it you will have something worth thinking about to occupy your mind."

*

" We broaden our field of knowledge and reach generalisations of considerable magnitude as the result of numerous small thoughts brought together in the mind and carefully considered."

*

" All really big discoveries are the result of thought patiently pursued."

Alexander Graham Bell on "Discovery of Invention."

THE MIRACLE OF RADIO

The Idea of Maxwell, Hertz and Marconi

TELEGRAPH, telephone, radio : the story of the conquest of communication by electrical energy has three chapters, and the marvels of the first and second pale before the miracle of the third. Even to-day, with the whole world encircled and indebted in a thousand ways to this most modern child of Hermes the Messenger, we are only at the beginning of its vast possibilities. To-morrow the science of healing, the control of vast forces, navigation, aeronautics, television, the amenities of life in a score of directions will be dependent on these electrical waves which need no wires to guide them, but spreading in all directions with the rapidity of light find the instruments turned to receive them, or directed into a beam travel straight to their goal through that unknown element which at present we call the ether.

The names of three men—an Englishman, a German and an Italian—stand out from the many who have opened up for us this new path of progress : James Clerk Maxwell, Heinrich Hertz and Guglielmo Marconi. [Maxwell prophesied wireless, discovering its principles ; Hertz discovered and demonstrated those waves which are its secret ; and Marconi invented the instruments which put these ideas to practical use.] A crowd of other brilliant men have made their different contributions. Sir Oliver Lodge came very near to doing what Marconi did ; indeed, a year before Marconi invented his instrument, Lodge demonstrated the possibility of sending a signal by these Hertzian waves, but turned aside under pressure of other work. Professor Righi, Marconi's science master, experimented in the laboratory and showed young Marconi the potentialities. Oliver Heaviside, the English telegraphic engineer, subsequently revealed to us the amazing fact that these wireless waves are thrown back to the earth from the two curious "mirrors" which,

moving in the depth of the sky hundreds of miles from the surface of the earth, act as a kind of double sounding board. These are but a few of the men whose work all over the earth has brought the miracle of wireless to its present stage. But the three names stand pre-eminent.

James Clerk Maxwell was born in 1831. A brilliant scientist, with the kind of intuitive genius we associate with Newton, he had a theory that light and electricity were in some way parts of the same thing. But how to prove it? That might well have seemed a hopeless task, until he planned to measure the movements of the waves of electricity and those of light; for he felt sure that this electrical energy did move in waves, those forms which move through space in a regularly repeated shape. The waves of the sea moving through water; the waves of sound moving through the air from some vibrating instrument; the waves of light and of electricity moving through the ether: could he establish the measurements of these last? Could he give the "wave-lengths," *i.e.*, the space between crest and crest, and the frequency, *i.e.*, the time it took each wave to pass any given point in space? In his day no instruments had been made which could register the enormously long waves of electricity. All his work, therefore, lay in the realm of mathematics, of calculation, and the prophecy from this. His triumph was the discovery that, as he had hoped, light waves and electric waves moved at the same speed, something like 186,000 miles per second. Wireless, the undiscovered, was to establish the link between them.

Twenty-three years after Maxwell had made this discovery, Heinrich Hertz proved the truth of his theory. By that time it was possible to make tests with electric currents of shorter frequency. Using these, he revealed that the waves of electricity behave exactly as other waves in nature do. But all Hertz could do was to demonstrate across the few feet of a laboratory, for there did not yet exist any instrument which could magnify the received waves with sufficient strength to use them for any kind of signal. The new waves—Hertzian waves they were called in honour of their discoverer—finally established the possibility of wireless communication. Again there was a pause while the right man came into the world to bring these discoveries of abstract science into the practical service of mankind. In 1894 Oliver Lodge showed that it could be done,

and had he pursued that line of research might easily have added to his triumphs this of practical radio. But over in Italy a twenty-year-old scientist had become obsessed with this idea.

Guglielmo Marconi was the son of an Italian father and an Irish mother, with his home near Bologna. His master of physics, Professor Righi, had shown him that the waves of electricity pass through the earth and jump intervening space so that their faint crackle could be heard in a receiver placed some distance from the other end of the wire. Hertz had received those. Another experiment of Professor Righi's told the same story. He had two coils of wire placed some distance apart. In one of them there was a gap of several inches, and through this coil the Professor sent a charge of electricity. With a flash of electric fire the current jumped the gap and, more miraculous still, the other coil of wire lying apart received the shock sent out by the flash. From every experiment the same truth was apparent—electric force did not need wires to carry it from point to point, it could jump space.

With funds supplied by his father young Marconi pursued this truth, experimenting across the garden of his father's house. Two poles at opposite ends of the garden ; a wire with a spark gap ; a Morse telegraph key to release and control the current ; a telephone receiver at the other pole which would receive the dots and dashes of the Morse code. Hertz had received those waves at a distance of a few feet ; Marconi obtained them at a distance of a mile. He discovered that a hill between his transmitter and his receiver made no difference—the magic waves went through matter as easily as they passed through air. The problem was to produce signals strong enough to be recorded, and this depended firstly on having a good length of aerial in which the electrical vibrations could take place. Marconi made the discovery that if he placed his aerial vertically instead of horizontally, he obtained maximum strength. It acted as though he had doubled the length of his aerial, as though one half of it were buried in the earth.

Marconi came to England and submitted his invention to the British Government in 1896, and the next year the Marconi Wireless Telegraph Company was founded. He interested the British Post Office and experimented from the roof of the General Post Office at St. Martin's le Grand in London. He worked on Salisbury Plain,

and then sent messages across the Bristol Channel. In 1898 the invention was used in the British naval manœuvres ; the next year signals were sent across the English Channel. Marconi's dream of linking nation to nation drew nearer. One moment of triumph came when Queen Victoria, staying at Osborne House, sent a message to the Prince of Wales on board the royal yacht, for not the least part of Marconi's vision was that ships at sea could be kept in constant touch with the land and with each other. Another possibility became certainty when the *Dublin Daily Express* used the invention to report the Kingstown Regatta.

But all these pioneering experiments and applications were over comparatively short distances, and the doubters still did not believe in the unlimited range. They argued that the curve of the earth would interfere. Marconi planned his supreme test. At Poldhu, in Cornwall, he set up his signal station, and during the December of 1901 he crossed quietly to Newfoundland. He did not dare to disclose a plan which might fail, but he had arranged with his assistants in Cornwall that at a certain hour of a certain day they should transmit the three dots signal of Morse, and he would listen in on a telephone attached to a nine-feet kite flying four hundred feet in the air. If the electric spark could be recorded over three thousand miles of sea, all things seemed possible. On the test day the men in Cornwall flashed a spark a foot long and as thick as a man's wrist across the gap in the enormous coils of wire, and at that moment in distant Newfoundland Marconi heard the treble signal. Wireless had conquered space

Since those days there has been no turning back. Marconi himself superintended the establishment of a wireless set which recorded on shipboard news from the land. In 1903 a ship used wireless for the first time to send distress signals, when the liner *Republic* collided with another in the Atlantic ; and the long record of saving life at sea by wireless began. To-day every ship is equipped and keeps in constant communication with the land.

In 1924 Marconi carried his invention one important step forward when he arranged a method of directing the wireless waves in a straight line. It spelled a tremendous advance, but this whole invention is continually expanding into fresh triumphs. The world of the future will use these electric waves in ways now only dreamed of,

for they are the most potent, the most unlimited form of power which the mind of man has conceived. The day is not far distant when aircraft will be directed from the ground by wireless energy ; when medicine will turn it to its purpose of healing ; when all communication, public and private, will be by this means ; and the dream of the twenty-year-old Italian boy to use the discoveries of the British and German scientists will find its ideal fulfilment in a world completely in communication.

* * *

MARCONI

Requiescat in pace ? No,
I do not think that you will rest,
but, swift among the stars, will go
forward with your immortal quest.

Keep silent, shade among the shades ?
I do not think that you will wait
for some last trumpet, you who made
our human world articulate.

But some still morning, from afar,
faint, but crystal clear will come
your signal, through death's gates a-jar :
Marconi calling, from his home.

FROM BALLOON TO AIR-LINER

The Idea of Aviation

"To conceive a flying machine is nothing. To construct one a little. To fly one is everything."

THE words are those of Otto Lilienthal, one of the pioneers of flight, whose gliders carried the art of aviation to the threshold of the actual power-driven aeroplane, and whose death in 1896 was the immediate cause of the Wright Brothers devoting themselves to aeronautics.

To conceive a flying machine. Since man began to think, this vision of the conquest of the air haunted him. Back in the very dawn of history the story of Dædalus and his son Icarus escaping from King Minos, of that venturing too near the sun which melted the wax of the wings of Icarus, confesses the dream in earliest classic Greece. All through the Middle Ages and into the Renaissance the idea continues. Roger Bacon, the father of modern science in the thirteenth century, experimenting with the lifting power of cylinders filled with hot air; Albert of Saxony in the fourteenth century; Leonardo da Vinci, that proud spirit of Renaissance Italy, trying to break free from the cumbering earth on vast wings modelled on those of the birds; another intrepid Italian who jumped winged from the walls of Stirling Castle to demonstrate before King James the Fourth; from age to age the vision held. Sometimes it was expressed fantastically as when the poet Cyrano de Bergerac dreamed of being carried aloft on globes filled with morning dew; but more practical men, as we have seen, worked on two principles: Roger Bacon's lighter-than-air cylinders and Leonardo's wings—the balloon and the aeroplane.

It was the end of the eighteenth century, however, before the first balloon took man triumphantly into his newer element, and

the dawn of the twentieth before the first heavier-than-air machine driven by power blazed the trackless path of the modern aeroplane.

The balloon was that of the Montgolfier Brothers at Annonay in France. They owned a paper mill, and it was the sight of the smoke ascending the chimney which started their dream. Suppose......... suppose a vast silk bag were filled with smoke. If it were large enough it might carry a platform built beneath it where a man could sit who could go on burning straw beneath the inverted opening of the bag. They seem to have thought it was smoke which had the ascending quality, not realising that actually it was hot air. But they tried out their scheme. At first the silk bag was sent up unattended ; it rose seventy feet. The next time it went up 6000 feet before it was drawn down again by the rope on which it was tethered. In 1782 the experiment was to be repeated in Paris, and King Louis invited the brothers to demonstrate it before the Court of France. More importantly, this time it was to convey a passenger. But whom ? The king solved the problem by proposing that two criminals under sentence of death should take the trip. They were to die anyway. A certain Pilatier de Crozier, however, claimed that this first flight was an honour worth a man's risking his life for and not a penalty to be wasted on condemned criminals. He volunteered, and was the first man to leave the earth and travel in the air.

On that occasion, however, the balloon was still tethered, but shortly afterwards the Marquis d'Arlande made a five-mile flight across Paris in a similar balloon blown on its journey by the wind. At one moment it caught fire—small wonder, for the principle was still that of hot air kept going by a fire in the car under the open neck of the bag. D'Arlande was able to extinguish the blaze with a sponge, and survived the voyage to have his coat torn to pieces by excited and enthusiastic souvenir hunters at the journey's end. Alas ! shortly afterwards another balloon he was sailing did catch fire and he lost his life : the first of a long line of martyrs in the cause of aviation.

Two Englishmen, Blanchard and Jeffries, crossed the Channel in a balloon in 1784 ; and the same year Madame Thiblé made a successful ascent and was thus the first woman aeronaut. All through the nineteenth century the excitement of balloon travel went on. Methods of guiding, the use of lighter-than-air gases, even the first attempt at

using steam-power ; but it was not in that direction—even though it led to the giant dirigibles, the Zeppelins and the ill-fated R. 101—that conquest came.

During the nineteenth century three English engineers worked on heavier-than-air machines and prepared the way for the ultimate triumph. George Cayley toiled for more than fifty years until his death in 1857 studying the right shape of wings, the best type of control, air-screw and power engine. About the middle of the century two brilliant engineers took up the quest. One was W. S. Henson, who after wonderful research made a model aeroplane which embodied all the principles upon which success ultimately arrived. Having spent all his money on the model, he tried to float a company to build the first real aeroplane. But nobody cared, and in deep disappointment he went to Texas and dropped the whole project.

John Stringfellow had a similar experience. His model worked wonderfully in his own experimental shed at Chard, Somerset, and was invited as an entertainment to the public at Cremorne Gardens, but, given wrong conditions there, it failed to draw the crowd and was forthwith dropped. So though the inventor exhibited models and won prizes at the shows of the newly formed Aeronautical Society of England (the first in the world), and although his models were sound in construction and principle, nobody financed him, and aviation had to wait nearly forty more years for its first aeroplane.

Meantime, in Germany, Otto Lilienthal watched the birds, made hundreds of sketches of birds' wings over a period of twenty years, and in 1891 made his great glider as the result of this research. Above all else, he demonstrated that the air was not a constant element but, like the sea, a thing of currents, whirlpools and vortexes, so that flight was not merely a question of sustaining a weight in the air by upward pressure of air on the under-surfaces of the wings. It needed constant navigation. He wrote a book on the findings from his five years' ceaseless practice and the two thousand flights which he made. Then, on 12th August, 1898, he was killed.

Across in America two brothers read the obscure newspaper paragraph of the " bird-man's " death. Their names were Orville and Wilbur Wright. They, too, were enthusiasts for flight ; indeed, had been enthusiasts since their father gave them a toy helicopter

when they were boys. Now they were partners in a bicycle business at Dayton, Ohio ; but they read Lilienthal's book, and they dreamed of making an aeroplane. Like him they watched the flight of birds continually, trying to wrest from their movements the secret of the air. When Lilienthal was killed on his glider they, as it were, took the torch from his hand.

For five years they worked patiently on their machine. They made a wind tunnel in which to try out models. By 1900 they had a glider ; two years later a biplane with a petrol engine to give it power ; and on 17th December, 1903, they took their man-carrying plane to the sandbanks at Kitty Hawk in North Carolina. They sent a word of invitation to many people to witness their trial flight, but it was a cold morning, and four men and a boy came out. On that bleak winter morning history was made. The Wrights flew their machine again and again, hundreds of feet it moved under their control, landing at points higher than those from which it started. It spelled triumph. Nobody paid any attention : the newspapers made no comment for days, and then only the slightest. When one star reporter saw the "scoop," which that story should have been, his editor in distant New York dropped his article into the waste-paper basket. The local editor at Dayton, when the Wrights returned there and flew five miles, said to the younger brother : "Look here, Orville, if ever you do anything unusual one day, be sure to let me know."

Wilbur and Orville Wright were not seeking newspaper paragraphs, however. It dawned only gradually on the world that these two men had solved the problem which for thousands of years had teased the minds of men.

"The bird that talks most is the parrot, and that is the bird that flies least," Wilbur was fond of saying, and they went on steadily working at their planes.

In truth that bleak morning on the sandhills had begun a new era in man's history, and since then flight has moved forward from conquest to conquest. In 1905 the Wrights flew twenty-five miles ; in 1908 they demonstrated before the military authorities and flew nearly fifty-one miles ; the next year Bleriot crossed the Channel ; ten years later Alcock and Brown flew the Atlantic, and Kingsford Smith crossed the Pacific ; Wiley Post went round the world,

15,000 miles, in eight days; Byrd flew to the North and the South Poles. The terrible use to which man has put the aeroplane in war is a chapter in this story which we hope one day to forget or only to remember with shame. To-day, with the jet-projected screwless aeroplane an accomplished miracle of aerial travel, promising movement at 500 miles or more an hour through the sub-stratosphere, we find it difficult to remember that only forty years separates us from the triumph of Orville and Wilbur Wright on the sandhills of Carolina. To-morrow ?

* * *

HIGH FLIGHT

" Oh, I have slipped the surly bonds of Earth
And danced the skies on laughter-silvered wings ;
Sunward I've climbed, and joined the tumbling mirth
Of sun-split clouds—and done a hundred things
You have not dreamed of—wheeled and soared and swung
High in the sunlit silence ; hov'ring there,
I've chased the shouting wind along, and flung
My eager craft through footless halls of air.

Up, up the long, delirious, burning blue
I've topped the wind-swept heights with easy grace
Where never lark, or even eagle flew—
And, while with silent lifting mind I've trod
The high untrespassed sanctity of space,
Put out my hand and touched the face of God."

(This sonnet was written by a nineteen-year-old pilot, John Gillespie Magee, who has since been killed in flight.)

THE SIGN of the RED CROSS

An Idea of Henri Dunant

ON 24th June, 1859, at the tiny Lombardy town of Solferino, was waged one of the bloodiest battles of history. The Sardinian and French allies under Napoleon the Third stormed the town held by a strong force of Austrian soldiery under the command of the Emperor Franz Joseph. As though the elements themselves shared this mad violence of war a tremendous storm raged over the battlefield, lightning and thunder mingling with the roar and flash of cannon and musketry. For fifteen hours the carnage lasted, and when at last the Austrians broke and fled they left more than forty thousand wounded behind.

One strange spectacle of the ordered world intruded upon this nightmare scene: a private carriage drove to the battlefield, its occupant a young man of about thirty, dressed rather immaculately in a fashionable white coat. His name was Jean Henri Dunant. He was a French banker and company promoter, and his presence at Solferino that tragic day was in connection with his business, for he had been trying to obtain from the French Government certain concessions in connection with a business venture in Algeria, and being refused by the Colonial Department in Paris, had decided to go personally to the Emperor Napoleon in the midst of the successful campaign against the Austrians and urge his case. That business mission failed; Dunant did not find the Emperor on the fateful day. Indeed, so far as his business affairs were concerned, he sowed the seeds of ruin on the bloodstained battlefield, for something took hold of Henri Dunant which was destined to sweep all else out of his life. Horror, pity, the need of helping human suffering at its most dire; these things took possession of him, broke the comfortable pattern of his life and built it anew in a symbol which

to-day the whole world knows : the merciful symbol of the Red Cross.

At first it was only the immediate urge to help the thousands upon thousands of wounded men who lay in agony where they had fallen, their wounds putrefying under the blazing sun, their tongues blackened with thirst, their minds maddened with pain and despair. Into this inferno the man with the white coat plunged to give what help he could. Carrying water and wet lint he bathed the wounds, bound them where he could, gave drink to the thirst-maddened creatures who clutched at him as he passed. Day after day it went on. In the neighbouring village of Castiglione he improvised some sort of shelter in the houses. He recruited a band of three hundred helpers, and sent them out over the battlefield. At one point he found a company of more than five hundred wounded men in a church, men who for five days had been totally forgotten and left to the horrors of their wounds, fever, thirst, hunger and vermin. French, Austrians, Slavs, Arabs, Germans : friends and enemies lay together in the horror which followed battle.

" *Siamo tutti Fratelli.*"

" We are all brothers " : it became the watchword of that band of helpers which Dunant recruited among the simple Italian peasantry : the watchword of mercy.

Back in Paris and in his native Geneva, Henri Dunant tried to forget, to turn again to his business affairs. But when Destiny has taken a man by the sleeve, she does not so lightly loosen her hold. At first he was physically ill with the terrible strain of those days in Lombardy, and even when his health recovered his mind could not free itself from what he had seen. His business no longer seemed of paramount importance : the Algerian company went from bad to worse, his shareholders became restive.

In 1861 he tried to exercise this thing. He wrote an account of what he had seen in a tiny book. *A Memory of Solferino* he called it, and he printed a thousand copies and sent them to his influential friends. That booklet was Destiny's second move. It was a piece of realism which might have formed a chapter of Tolstoy's *War and Peace,* and it stirred the conscience of Europe. Like a flame it ran across the world. Edition after edition was needed ; and wherever it went men and women asked : What can be done ?

Four of Dunant's friends in Geneva especially turned themselves to the task. General Dufour ; Gustave Moynier, the energetic President of the Geneva Welfare Society ; Dr. L. P. Amédée Appia ; and Dr. Theodore Maunois, a wealthy surgeon. With Dunant himself they formed a committee of five, and they began by issuing invitations to an International Conference at Geneva. Dunant went forth as the ambassador for the venture. His book had already made influential friends for the cause, and Dunant went from country to country, urging the idea upon government officials and great personages in court and other circles. He wrote thousands of letters, sent more and more copies of the book, interviewed, begged. Where he could not go he wrote, as he did to Abraham Lincoln, from whom he obtained two American delegates. The French Minister of War attacked him, declaring that his *Souvenir* was an indictment of France, and forthwith Dunant went over his head to the Emperor and secured Napoleon's interest.

In October, 1863, the first Conference was held at Geneva. Twenty-three delegates from seventeen nations met under the presidency of Moynier, with Dunant acting as a secretary. During that four days' Conference Dunant did not speak. Moynier, the able lawyer, more and more took matters in hand ; and maybe Dunant, like many another pioneer dreamer, watched almost in fear his winged vision settle down to the common clay of practical fact.

The next year the Swiss Federal Government issued the invitation to the Conference, and that year the first Geneva Convention was drafted and agreed, and the rules for the care of the wounded became part of international law. The basis has never been changed. Convention after convention has been needed to expand the work, but the principles which were established in 1864 have always remained.

It was in 1864, too, that the organisation was called to justify itself in the Prussian war against Denmark. Dr. Appia, undertaking active service for the wounded, wore as an armlet a Red Cross on a white field. For that token of mercy he obtained recognition from civil and military authorities alike. And the great work found its symbol. The armlet which Dr. Appia wore eighty years ago is still one of the treasures of the International Committee.

And Henri Dunant ? Perhaps that is the strangest part of the

story. When the Conference of 1864 met Moynier again dominated it; indeed, for fifty years he was the President. Dunant, the once brilliant business man, was under a cloud, for he had followed his dream too thoroughly. The Algerian affairs had gone from bad to worse, and soon all his financial doings slipped down into disruption. Bankrupt, ill, friendless, and on the verge of that persecution mania which ultimately beset him, Henri Dunant was quietly dropped by the great organisation at Geneva. He tried to exist on the strength of the literary reputation from the *Souvenir*, but nothing came of it. Nobody wanted or heeded him, and he disappeared. Only the Red Cross went on from strength to strength.

Fifteen years later, in the little alpine village of Heiden, he reappeared, an eccentric elderly man, with a long white beard which went nearly to his knees. It was the young village schoolmaster, Wilhelm Sonderegger, who recognised in the stranger the founder of the Red Cross, and he and his wife befriended the old man, and brought him back for a time to something like his old enthusiastic self. The International Conference was to be held in Rome, and Dunant urged Sonderegger to attend. But the scheme came to nothing, for there was no money for the journey, and although Dunant tried to raise a tiny fund there was never enough. The man who had canvassed the courts of Europe was unable to raise a few hundred francs. Sonderegger, prevented from going to Rome, secretly wrote a letter to the Conference, telling them of Dunant's presence in his village. That letter from the village schoolmaster was the sensation of the occasion. Great people bestirred themselves to try to give the old man his rightful place in this vast organisation which he had started. Some came to Heiden to see him The newly established Nobel Peace Prize was first given to him in company with another. But it was really all too late. His mind, wounded by that world for which he had done so much, was unable to respond. Even with Wilhelm Sonderegger he found a grievance; and, although the last eighteen years were spent in comparative comfort in the little hospital at Heiden, Dunant never recovered the years of neglect. He died in 1910.

"I desire to be carried to the grave without any of your ceremonies which I do not acknowledge," he had said to Sonderegger. "I rely upon your friendship that it shall be

done thus with me. I am a disciple of Christ like those of the first century, that is all."

To-day more than ever, we realise the tremendous service he did for the world. The wounded, prisoners of war, civilians, refugees, internees ; as the effects of war become more universal the work of the Red Cross expands to meet it. Always the organisation at Geneva has managed to keep its allegiance to its own work of mercy above all national and partisan suspicions, so that it goes from strength to strength, unhampered, trusted, acting still on the belief which moved Henri Dunant and his improvised little band on the field of Solferino : " We are all brothers."

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" When shall we see a life full of steady enthusiasm, walking straight to its aim, flying home, as that bird is now, against the wind—with the calmness and confidence of one who knows the laws of God and can apply them ?"

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" Why cannot we make use of the noble rising heroisms of our own day instead of leaving them to rust ?"

Florence Nightingale.

NATIONS AS NEIGHBOURS

Woodrow Wilson and the League of Nations

IN these latter days, under the shadow of the second great world war, we tend to dismiss as a failure that League of Nations which came into being at the Peace Conference of 1919 and for some years gave us hope that war was indeed outlawed. But despite its obvious failings and failure in the major task, despite the evidence of the tragic history of the 1930s, and despite our cynicism, this idea of a League of Nations to save the world from war has to come in some form or other. Perhaps we could hardly expect the first courageous experiment to succeed. We might remember that it took nearly two centuries to outlaw slavery; and now that humanity in its upward struggle has started to rid itself of war, the greatest of all its age-old evils, we could hardly expect success with the first attempt. "The League is dead; long live the League." Under its old name or a new one; cleansed, we hope, from some of the things which made its first failure inevitable: more realistic, more potent, this idea must go on. Those of us who believe in civilisation must see that it does.

> "The whole enterprise of the League is a great adventure, and an adventure based upon a great repentance," said Gilbert Murray.

Like many another experiment, this one did not win through at its first essay. Humanity must try again. Meantime, because one day the adventure will succeed, it is interesting to remember again how the idea of the League of Nations came into the world, and to pay tribute to Woodrow Wilson, who fathered the scheme and whose tragedy it proved to be. Nor must we forget the great part played in its inception by General Smuts, who had been planning along the

same lines, and whose statesmanlike Memorandum was part of it from the beginning.

Thomas Woodrow Wilson was born in Virginia in 1856. At first the pattern of his life was that of many Americans of his type : fairly successful practice as a lawyer, college professor, and then president of a university. Wilson, after he was President of Princeton University, seriously entered the political field and became the governor of New Jersey as a Democrat. He was always an idealist —a somewhat cold, humourless person, but in deadly earnest. When he became governor he began certain vigorous reforms which clashed with the interests of big business and finance and brought him into the forefront of American politics : also it sowed the seeds of that enmity by certain factions which was ultimately to prove his undoing. In 1912 he became President of the United States of America, and continued in his rather grim fashion to fight the financiers of Wall Street and the great banks. His puritan temperament alienated him from the important people even of his own Democratic Party, and soon this almost friendless man found himself carrying the burden of his office in an atmosphere of isolation.

In 1914 came the European War. Wilson was by conviction a pacifist, and his policy was to keep the United States out of the battle. From the start he saw himself in the rôle of arbitrator when Europe finished the strife. Alongside of this attitude was his concern—and that of all America—that neutral shipping rights should be observed, and this joint policy of isolation and firmness about American rights secured his re-election. That was in 1916 ; but by 1917 America had been forced in by the sinking of her ships by U-boats and by the amount of money which the financiers had loaned.

In America and in Europe during those dreadful years the necessity of setting up some kind of machinery to prevent war recurring was being urged by the idealists. In America the League to Enforce Peace was leading this policy, and although Wilson was at first hostile he made a speech at a banquet given in May, 1916, which declared his agreement.

> " Henceforth alliance must not be set against alliance," he said ; " but there must be common understanding for a common object. The nations of the world have become each other's

neighbours ; it is imperative that they should learn to co-operate."

Thereupon he laid down the principles and conditions which he would suggest for the settlement of the war. Early in 1918, his own country having been meantime drawn into the conflict, he crystallised those principles into the famous Fourteen Points, and the Fourteenth read :

> "A general association of nations must be formed under specific covenants for the purpose of affording material guarantees of political independence and territorial integrity to great and small states alike."

By that time the Russian Bolsheviks had successfully revolted against the Czarist government and had withdrawn from the war. Things were looking black for the Allies ; but Wilson's faith remained unshaken, and it was a faith in this proclamation of justice which would bind victor and vanquished. When in the October of 1918 Germany realised the inevitability of defeat, her Chancellor made his appeal for an armistice first to Wilson. Strangely, the President was most suspicious of the good faith of the request, and quarrelled anew with his colleagues, shut himself up and carried on the tremendously important negotiations alone and in secret, tapping out on the old typewriter he had brought with him from Princeton University documents which were to change history.

It was in such an atmosphere that Wilson left America to attend the Peace Conference. When he arrived in Europe hostility was replaced by idolatry. To the Allies he was the representative of America whose intervention half-way through the struggle helped to turn the scales of the war ; to the defeated he was the just man who would save them from the hatred of the French ; to the new nations which were promised existence, Poland, Czecho-Slovakia, he was a saviour. Streets and railway stations and innumerable babies were named after him. His portrait sold in millions. He made a triumphant tour of the European capitals, and "it was roses, roses, all the way."

In January, 1919, came the actual Peace Conference. Wilson expected naturally that he would preside, for he did happen to be the only Chief of State present ; Germany had accepted defeat on the promise of his Fourteen Points ; and, moreover, the United

States was by far the most powerful because the least exhausted of the Allies, her eleventh-hour intervention having left her forces unimpaired. Wilson forgot Clemenceau. That crude, forceful, badly-dressed little man, moved by implacable hatred of the Germans, dominated the Conference, checked slightly by Lloyd George. So it was he who presided. French ideas ruled and dictated the terms and tore holes in Wilson's Fourteen Points. Clemenceau's rudeness to the President was continual and brutal.

At last Wilson realised that out of this wreck of his dreams he might salvage one precious thing which would hold hope for the future—the Fourteenth Point, the League of Nations. With the aid of Lloyd George he saved other things from the vengeance of the Frenchman ; but the League was the principle which counted most, and on this he found strong allies—the smaller nations, and such great personalities as Lord Robert Cecil. Most powerful of all was General Smuts, who, in December, 1918, had published *The League of Nations : a Practical Suggestion*, and who drew up a Memorandum which was largely incorporated in the final Covenant.

When the Conference appointed a committee to draft the constitution of the proposed League, Wilson again came to the forefront and presided. From the beginning, however, the ideal was jarred by the fears and jealousies of the traditionalists. France stipulated that Germany and the ex-enemies should be kept out of the scheme ; a Japanese proposal to declare complete racial equality was rejected, America remembering her negroes, England her Hindus, and everybody the yellow races ; nobody wanted the Russians with their avowedly anti-capitalistic doctrine ; and America forced Wilson to restate the old Monroe doctrine of non-interference with any affairs which did not immediately affect her interests. As the constitution emerged, therefore, it became more and more weather-beaten.

On 28th April, however, the Covenant was accepted by the Conference. That day was Woodrow Wilson's truly great moment. He believed that he had created an instrument which, as passions died down, would save the world. He believed that the glaring errors of the Versailles Treaty would be gradually rectified by his League. He planned that its permanent home would be in Washington under his benign eye.

Alas for those hopes ! Within a year the U.S.A. had completely

repudiated the League and refused to be a member. The dream of its home at Washington crashed, and with it Wilson's political career went down in ruin. His death early in 1924 was that of a man utterly abandoned and scorned by the world he had tried to serve.

> "To Woodrow Wilson, the apparent failure, belongs the undying honour which will grow with the growing centuries, of having saved the 'little child that shall lead them yet.' No other statesman but Wilson would have done it. And he did it."

That tribute was paid to Wilson by the man who might almost claim to stand alongside him as the founder of the League idea, General Jan Christiaan Smuts. It may stand as his memorial when history has silenced the criticism of his detractors.

So much for the man; but what of the League? In our present reaction we tend to forget how much it did. The idealists of the world rallied round the newly born institution in its home at Geneva, which was already the headquarters of the Red Cross and somehow had a tradition of Internationalism. On the major issue of war between nations the idealists fought a losing battle for more than ten years, but even on that great issue the League had notable successes, and settled more than fifty international disputes. When the Jugo-Slavs invaded Albania in 1922 the League enforced their evacuation in nine days; a war between Poland and Lithuania was stopped; the invasion of Bulgaria by Greece was stopped by a telegram from Geneva; when Italy attacked the island of Corfu the League again saved war. Marvellous, if less spectacular, work was done in other directions. Under that great man, Nansen, millions of refugees and prisoners of war were repatriated; the suppression of slavery became a foremost concern of the League; traffic in drugs and the scandal of white slavery were dealt with as never before; labour conditions and the welfare of the workers were considered internationally by the International Labour Organisation on a scale impossible before the League set up its machinery; trade relations between nations were rectified; and magnificent work was done by the Institute of Intellectual Co-operation for the Culture of the World.

The inherent weakness was that each state still regard retaining the sovereign right of force, and gradually the ol

istic attitude to war won back again. As we have seen, League policy was, from the beginning, weighed heavily on the side of the victorious Allies, and gradually Europe slipped back into the national anarchy which the League was planned to prevent. The history of that failure is too well known to need reiteration : Japan unrestrained in Manchukuo ; Italy in Albania and Abyssinia ; Germany disappointed by the failure to make good the ameliorative promises of the Peace Treaty, taking the law piecemeal into her own hands ; the whole rise of aggression ; the fear of intervention even by great powers committed to it ; and finally world war again and the need to face the whole task afresh.

But the idea behind the League of Nations is abroad in the world, and International Co-operation must be resurrected in more potent form to succeed where first it failed. The form may change, the name may be different, fresh direction may be given, but the evolution of civilisation is moving in the direction of the outlawry of war, and inevitably evolution will win.

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" Civilisation is one body, and we are all members of one another."

General Smuts.

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" The League of Nations may be idealistic, but it is a preference of spiritual to material things."

Lord Robert Cecil.

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" We forget that the human spirit, the spirit of goodness and truth in the world, is still only an infant crying in the night, and that the struggle with darkness is as yet mostly an unequal struggle.

" It was not Wilson who failed, but humanity itself. It was not the statesmen that failed so much as the spirit of the peoples behind them."

General Smuts.

HAVING ALL THINGS COMMON

Communism from Plato to Stalin

WHATEVER we may feel personally about communism it is certainly the most challenging idea in the world to-day. An old idea : for did not Plato, four hundred years before Christ, write that master-work, *The Republic*, picture of a communist state which has never ceased to influence the thoughts of those who were seeking a way of living together in justice and righteousness ? A new idea : the ideal behind the greatest political experiment in the modern world, the attempt to govern the Russian Soviet States. And in the intervening centuries again and again men have dreamed of a world where property is possessed communally rather than individually, and where each man lives for all men and all for each. That is the ideal essence of communism.

It was the first reaction of the early Christian Church to the teaching of Jesus.

> " Neither said any of them that ought of the things he possessed was his own ; but they had all things common. And distribution was made unto every man according to his need."

It was an ideal to which Christianity continually returned. The monastic system was itself a limited communism ; St. Francis preached it in the thirteenth century ; John Ball in the fourteenth ; Thomas More, statesman as well as saint, in the sixteenth when he wrote his *Utopia*, first of a hundred books of imaginary communist states.

Every century brought its theories and its experiments. There was a fascinating person named Gerald Winstanley in Cromwellian England who started a community of " Diggers " on St. George's Hill. There was Mably of eighteenth-century France, a disciple of Rousseau, who shared that master's passion for equality.

> " The State as universal owner will distribute to each citizen the possessions he needs."

That is the basis of the theory as it swept over Europe on the wave of the French Revolution. William Godwin was but one, if the most powerful, of its advocates in this country. His reason, like that of so many of the men of his period, was ethical. Only by removing the selfish urge towards personal material possessions, they argued, could men become truly good.

Meantime the Industrial Revolution aggravated the problem. Inequality became greater; the factory system and the growth of the towns made the lives of the poor dreadful indeed. Modern social reform and modern socialism were born out of that desperate condition. It is interesting that the social reformers, and also the pioneer socialists, were rich idealists—Shelley, the aristocratic poet of revolt; Robert Owen, the capitalist co-operativist; Charles Kingsley, the novelist; John Ruskin, wealthy amateur of art and life; William Morris, artist-craftsman. Their name is legion in every country in Europe during that nineteenth century of unchecked competition.

Some of these men spoke, some wrote, some organised political parties; the more desperate advocated active revolt.

Meanwhile in 1818 at Treves, in Germany, was born Karl Marx, the man whose amazing one-track mind was destined to make this idea of communism dynamic. He began as a clever journalist full of the revolutionary ideas of socialism. When he was a young man of twenty-four he became editor of the *Rhenish Gazette* at Cologne, and made it the mouthpiece of that idea. In Germany in 1842, however, the authorities did not encourage editors with such theories: the paper was suppressed, and Marx, to escape arrest, fled to Paris. Again he edited a paper, *Forward*, and again it was banned, and he fled this time to Brussels.

During his stay in Paris he met another young German socialist, Friedrich Engels, who was travelling to England to manage his father's cotton business. Engels normally would have become a wealthy capitalist, but he sacrificed his worldly success and his health for this cause. He had a mind as clear as that of Marx, and the comradeship which sprang up between them gave Marx a lifelong friend who helped him in every way. Nor must we forget, in telling his story, the unswerving devotion of the aristocratic girl he had married, Jenny von Westfallen, the daughter of a Prussian nobleman, who

shared her husband's hard life of exile and poverty and worked loyally with him.

In Brussels in 1847, as in the rest of Europe, matters were rushing to the disastrous climax of armed revolt. Engels and Marx focused the whole movement in the famous Communist Manifesto, which was the real foundation of modern international communism. It was a brief statement of the ideals, the aims, and the methods of the movement. It gave a new interpretation to all history.

> "The history of all human society, past and present, has been the history of class struggles," stated the manifesto.

It was this idea of a continuous struggle between the possessing classes and the non-possessing which Marx declared to be the key to history. All movements, all changes, all wars, all important events, he believed, were the result of that struggle.

In 1848 spasmodic revolutions broke out in various parts of Europe, especially in France and Germany. At first it looked as though the new doctrines of violence had succeeded. Marx dashed back to Cologne and revived his paper; Engels took part in the rising in Baden. Engels had long associated himself with the Chartists in England, and was sure that this most industrialised of all countries would give the communist revolution its lead. But violence begets counter-violence, and in a few months the established governments of Europe crushed all revolts. The history of 1848 certainly upheld Marx's extreme theory of the class struggle It sent Marx himself, ill, penniless and temporarily discouraged, into exile again.

He came to London, while Engels went to Manchester. For thirty-four years until his death in 1883 Marx and the faithful Jenny moved from lodging to lodging in London, working, writing, intriguing for the communist movement, struggling with increasing bad health against enemies inside and outside the camp. Once, in 1871, it appeared again as if armed revolution might prevail, when the Commune was established in Paris. But again it begot violence greater than its own, failed dismally, and Marx went on with his writing and research in the British Museum Reading-Room. The vast work which he wrote he called *Capital*. He had published the first volume in 1867; further two were issued by Engels after his death. *Capital* became the bible of the communist movement.

Some of its conclusions and predictions have proved wrong. Its importance lies still in its interpretation of history.

Strangely, it was not from an industrial country that the application of the idea came. It swerved to Russia, where the tyranny of succeeding Czarist governments created a strong revolutionary movement. There in 1870 Lenin was born. He was the son of a nobleman, and his real name was Vladimir Ilitch Ulianoff. As a student at St. Petersburg University he was a rebel, and his family were under suspicion since his elder brother was executed as a suspected revolutionary. When he was twenty-nine Lenin himself was arrested and sent to Siberia, and when he returned after five years he gave himself entirely to the communist cause. For sixteen years he went about the world promoting that cause.

With a prophet's satisfaction he watched the 1914-1918 war, seeing it, as Marx would have done, as the inevitable result of competitive capitalism, and as an opportunity for the workers to revolt. The inefficient Czarist government, the uncared-for and ill-equipped Russian army, and the readiness of the workers and peasants to get out of the war were perfect conditions for the communist plan. In 1917 Lenin was permitted by the Germans to cross Germany in a sealed train, for they knew that he might persuade Russia to quit the war. In November of that year he seized power for the Bolsheviks and made peace with Germany. And Russia became a communist country under his dictatorship.

Never was a régime started under less favourable conditions. The country was completely exhausted ; a terrible famine swept over the food-growing districts ; there were risings within and enemies attacking from without to re-establish the old order. As with the earlier French Revolution the Bolsheviks countered this with a reign of terror. Anybody who did not agree with the régime was executed or imprisoned ; all freedom of speech or writing which was against the state was forbidden. Famine, civil war, disease, starvation, and this policy of political killing spelled the death of millions of Russians. It was a totalitarian state with no freedom of the personal kind, and complete ruthlessness in getting rid of its enemies or critics. The price paid was terrible ; but the régime, yielding now and again to elements too powerful to be overcome, succeeded in establishing and maintaining the fundamental structure.

Most remarkable was the fight for education under Commissar Lunarcharsky, though again we must remember that this was completely propagandist, for part of the scheme was to bring up the young as loyal communists. When Lenin died in 1924, Stalin took his place, and carried on the work.

The idea of communism was thus established as an experiment in the world. One-fifth of the land surface of the earth was under its government, and nearly 200,000,000 people. Fascism and Nazism in Italy and Germany arose to counter it, and copied the worst excesses of its methods of suppression and violence. Russia, particularly when forced into the second world war in companionship with the democracies, adapted itself to non-communist conditions. But the ideas of communism remain its ideal, and we may expect developments along these lines.

We cannot, in the world to-day, neglect this challenging experiment. The democracies of England and America have themselves been proceeding along lines of more cautious socialisation, and they are likely to continue to do this. Our problem is to achieve what is good in this great idea of communism without the terrible evils which went with its establishment by violence, or its suppression of freedom of thought and word. It is well to remember that great and good men, the greatest and the best in human story, have seen this vision before Marx allied it to his doctrine of revolution, and to work out a means of reaching its ideals of justice and righteousness without the waste and misery, the bloodshed and suppression, of wrong methods.

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" When people speak of ideas that revolutionise Society, they do but express the fact that within the old society the elements of a new one have been created, and that the dissolution of the old ideas keep even pace with the dissolution of the old conditions of existence "

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" Men make their own history, but they do not make it out of the whole cloth."

Karl Marx and Friedrich Engels.

THE DREAM BEYOND NATIONS

The Idea of Federal Union

ABOUT one hundred and fifty years ago something happened in America which challenges the world of our own time. Out of a desperate situation an idea was born ; an idea which a few men passionately believed, an idea which was thought by many even of the best men to be wildly impractical. But because the few who believed determined that it should, the vision became a reality, and the United States of America was brought into being. Thomas Paine, James Madison, John Adams, Alexander Hamilton, Benjamin Franklin, George Washington : to whom shall we give the honour ? It does not matter. Twenty-six-year-old Madison or the benign Franklin, with the world-wide reputation of his more than eighty years as a fighter for freedom and for truth, were equal in this thing. Hamilton's journalism or George Washington's dramatic fury at the meeting in Independence Hall in Philadelphia played indispensable parts. The future of the newly established American states was in the balance, and it was the shared effort of these and others which saved them from anarchy and ruin.

In 1782 England had been forced to grant to her one-time possessions in America their independence after seven years of warfare. Washington, who had led the American troops to victory, had been invited to become king of the new American States ; but he had always wished only to live the quiet life of a country gentleman, and there was a day in November of 1783 when he had bidden his officers farewell at the Fraunces Tavern in Philadelphia and had gone home to his lovely estate at Mount Vernon. The war was over. That great Declaration of Independence which Thomas Jefferson had drawn up so defiantly had been justified, and the thirteen States had only to go forward into the prosperity of the peace.

But it did not work so easily as that. The thirteen States *were*

thirteen states. Each had its own army, its own money, its own laws, its own trades and tariffs to protect them. Colonists from different parts of Europe, they spoke different languages and had different religions. Hear Thomas Paine in despair :

> "If there is a country in the world where concord according to common calculation would be least expected it is America. Made up as it is of people from different nations, accustomed to different forms and habits of Government, speaking different languages, and more different in their modes of worship, it would appear that the union of such a people was impractical."

Thomas Paine's hopeless pessimism was shared by many who lived through those years when the sun of victory set and the night of after-war depression descended. Another great liberal mind of the time gives us the same story.

> "As to the future grandeur of America," writes Josiah Tucker, the liberal Dean of Gloucester, "and its being a rising Empire under one head, whether republican or monarchical, it is one of the idlest and most visionary notions that ever was conceived even by writers of romance. The mutual antipathies and clashing interests of the Americans, their differences of government, habitude and manners, indicate that they will have no centre of union and no common interest. They never can be united into one compact empire under any species of government whatever ; a disunited people till the end of time, suspicious and distrustful of each other, they will be divided and subdivided into little commonwealths and principalities according to natural boundaries, by great bays of the sea and by vast rivers, lakes, and ridges of mountains."

Despite the League of Friendship which existed to hold the thirteen American nations together, every week, every month, saw them drifting farther apart. The after-war trade depression aggravated the situation as each one tried desperately to buttress its own interests against its fellows. Soon New York State was threatening war on New Jersey. There were everlasting quarrels about the position of the boundaries of the separate sovereign states, and disputes led to another threat of war between New York and New Hampshire and the State of Vermont, and between Connecticut and Pennsylvania. The League could not make its members do anything, for Congress

had no absolute power, no money in its treasury. It could not afford any longer to pay the general army, and the soldiers were dismissed and went looting the countryside.

The tariff questions were among the chief causes of trouble between the States. New England made rum from molasses and therefore wanted a low tariff on the molasses they needed to import and a high one on rum. Pennsylvania, however, having begun to manufacture steel wanted rum to be duty free, but a high tariff on steel ; and this clashed again with the interests of New England and South Carolina, both of which wanted the steel to be free of tax so that they should not be hampered in the building of ships and the making of agricultural instruments. So the game of beggar-my-neighbour was played from State to State inside the ineffectual League of Friendship.

Some of these questions the Congress nominally had the right to adjust. It could settle boundary disputes, for instance. But the Congress had to have a vote of at least nine of the States out of the thirteen to pass anything, so scarcely any outstanding problem of magnitude could be settled.

Thus things went from bad to worse. The currencies of some of the States were worthless, and they tried to pass laws to make their own people accept the notes they printed.

When people were brought before the Courts for debt in the widespread misery of the times armed bands of their friends broke up the proceedings. Things came to a head when a certain General Shay marched a body of men on the League's Arsenal in Massachusetts and tried to capture it. So powerless was the League that even in this desperate hour the State of Massachusetts refused to allow the troops of any other State to enter its territory to defend the common arsenal. Little wonder that in 1786 George Washington had written to a friend : " I am uneasy and apprehensive. More so than at any time during the war."

> " Under the universal depression and want of confidence, all trade had well-nigh stopped, and political quackery with its cheap and dirty remedies, had full control of the field,"

wrote the contemporary historian Fiske.

In 1786 the men who believed called a Convention with the idea

of cutting the Gordian knot of this State anarchy by putting all these sovereign states into one real Union. Federalists ; Federation : the challenging words went like wildfire from lip to lip. Newspapers grew violently pro or con the burning question. Hamilton's paper, *The Federalist*, was established to urge the new idea.

In May of 1787 the great Conference called by Congress met in Independence Hall in Philadelphia, in the very room where but a few years before the noble Declaration of Independence had been signed. At first it seemed that the plea to attend this Conference "for the sole and express purpose of revising the articles of Confederation" was doomed to failure, for they waited ten days before they had a sufficient number of representatives to form a quorum. But at last fifty-five delegates came ; not least the beloved Washington himself, the one voice to whom all Americans would listen.

But numbers were not enough. These men, sent there by democratic vote, were nervous of offending the voters. On every side the urge was for some easy compromise which would still leave the individual States to look after and defend their individual national interests. The representatives of the Southern States were especially keen upon retaining full State rights. How was the Preamble of the new Constitution to read ?

> "We, the people of the United States, in order to form a more perfect Union do ordain and establish this Constitution for the United States of America,"

or

> "We, the deputies of the Sovereign and Independent States," etc.

That was the crux of the whole question. Strangely, men who during the days of the war had declared, as Patrick Henry had, that "there were no Virginians or New Yorkers but only Americans," now spoke against the preamble in a fervour of local national patriotism. Compromise was in the air. It seemed as if even now the idealists would be defeated, when Washington, who was presiding, suddenly interposed. With all the solemnity of which the great soldier-statesman was capable he challenged this weak policy of playing for popular safety.

> "It is too probable," he declared, "that no plan we propose will be adopted. Perhaps another dreadful conflict is to be

sustained. If, to please the people, we offer what we ourselves disapprove, how can we afterwards defend our work ? Let us raise a standard to which the wise and the honest can repair. The event is in the hand of God."

It was that declaration which turned the tide. The Conference worked for a hundred days, but at the end its task was completed. State after State ratified the new Constitution, sacrificed its individual right to levy tariffs, to issue money, to make treaties, to keep its own army or navy. All these rights were given into the hands of the Central Government. To-day that Constitution governs four times as many States and forty times as many people as it did when it came to save the whole American experiment. Once, in the struggle of the Civil War, it had to be fought for during four terrible years of strife. Now it stands as one of the safeguards of right and liberty in the world.

It stands, too, as a challenge. The position which confronted the anarchic States of the North American colonies in those days confronts the world to-day. The difficulties of language, of conflicting trade interests, of different habits and opposing sentiments, of geographical boundaries, of national pride and the inevitable clash of loyalties ; these things constitute the problem of the world of our time as they did that of these men in knee-breeches and gold-laced coats who won a war and lost the peace in America more than one hundred and fifty years ago. Perhaps the last word can come from Tom Paine himself, an echo to our own from the midst of those troubled times : a challenge and a clarion call :

"We have it in our power to begin the world over again "

"E PUR SI MUOVE"

AND still it moves. The words of Galileo, murmured when the tortures of the Inquisition had driven him to recant the Truth he knew, apply in a new way to our world to-day. Sometimes, in the knowledge of all that has been discovered, all that has been done to make life on the planet happier and more worthy, we may be tempted to settle down to enjoy our heritage. That would, indeed, be the betrayal of our trust.

These men and women of the past have given everything—comfort, time, treasure, peace of mind and body, life itself—that we might live as we do. The challenge to each one of us is to carry on their work for the sake of future generations.

The adventurous human mind must not falter. Still must we question the old truths and work for the new ones. Still must we risk scorn, cynicism, neglect, loneliness, poverty, persecution, if need be. We must shut our ears to the easy voice which tells us that "human nature will never alter" as an excuse for doing nothing to make life more worthy.

Thus will the course of the history of mankind go onward, and the world we know move into a new splendour for those who are yet to be.

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